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Understanding and Telling Stories across Online and Real-world Cultural and Historical Artefacts

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Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Knowledge Media Institute

The Open University

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ABSTRACT

Storytelling is a natural way for humans to make sense of their world. Narratives structure experience into expected forms that improve understanding of relationships between discrete objects and events. This is the rationale behind museum curation, which organises objects in the physical museum space to reveal how they are related. This thesis explores how to support people to tell and experience narratives across multiple objects. For the online world, a model of curatorial inquiry is introduced which is designed to support a historical inquiry from online sources. This model extends existing inquiry models and is inspired by museum practice in which curators organize objects into museum narratives. For the physical world, a model is introduced that describes navigation through both the physical and conceptual neighbourhood of a set of objects. It is designed to support tourist activities across a non-portable set of cultural objects, such as statues, buildings, or landscape features. Key findings, based on both participant studies and analysis of data from Foursquare, is that while people are keen to understand stories that link places in a physical space, they prefer to navigate using physical, rather than conceptual proximity, and to visit places that are popular. This is counter to many mobile tour guides that focus on prompting navigation to similar places. The proposal of this thesis is therefore to develop applications that support tourists in understanding both what is physically nearby and conceptually nearby. This would allow them to use physical proximity - or any preferred alternative – to select where to go next, whilst supporting them to make links between the places they visit. In this way tourists would

be provided with enough information about the relationships of places within a physical neighbourhood that they can start to understand and create their own stories about them.

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I would like to acknowledge the support of my supervisors and colleagues in KMi, namely Paul Mulholland and Zdenek Zdrahal, for developing me as a researcher and for allowing me to explore interesting topics both in my PhD work and also my research positions. I am immensely grateful to Gerd Kortuem for allowing me to shift my focus when needed in the last year towards completing the experimental work and writing up of this thesis. Finally, I would like to acknowledge the support of my partner Dave and daughter Maija who have, with good grace, put up with me disappearing from family life for hours on end and who have helped life to go on around me while I did.

Publications

The research work presented in this thesis was used to produce the following research papers:

Wolff, A., Mulholland, P., & Zdrahal, Z. (2011). CHARACTER-EYES: story-driven inquiry from a character's viewpoint. In: *Computer Supported Education (CSEDU)*, 6-8 May 2011, Noordwijkerhout.

Wolff, A., & Mulholland, P. (2012, July). Qrate: historical learning through a curatorial inquiry task using web resources. In *Advanced Learning Technologies (ICALT), 2012 IEEE 12th International Conference on* (pp. 468-472). IEEE.

Wolff, A., & Mulholland, P. (2013, May). Curation, curation, curation. In *Proceedings of the 3rd Narrative and Hypertext Workshop* (p. 1). ACM.

Wolff, A. & Mulholland, P. (2014). Cultural learning across the smart city. In: *Smart City Learning*, 16 Sep 2014, Graz, Austria.

Wolff, A., Mulholland, P., Maguire, M., & O'Donovan, D. (2014, November). Mobile technology to support coherent story telling across freely explored outdoor artworks. In *Proceedings of the 11th Conference on Advances in Computer Entertainment Technology* (p. 3). ACM.

Wolff, A., & Mulholland, P. (2015, September). Navigation strategies in the cityscape/datascape. In *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2015 ACM International Symposium on Wearable Computers* (pp. 1143-1151). ACM.

The research ideas presented in the thesis developed from or contributed to the following publications:

Wolff, A., Mulholland, P., & Collins, T. (2013, May). Storyscope: using theme and setting to guide story enrichment from external data sources. In *Proceedings of the 24th ACM Conference on Hypertext and Social Media* (pp. 79-88). ACM.

Mulholland, P., Wolff, A., & Kilfeather, E. (2015). Storyscope: Supporting the authoring and reading of museum stories using online data sources.

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1. INTRODUCTION

People are narrative thinkers, naturally inclined to understand and relate personal experiences through stories (Schank, 1990). This is essential to the process of creating memories (Schank and Abelson, 1995). In addition to conventional dramatic stories, narrative principles can also be used to create coherent organisations of objects. One example of this is the museum practice of curating art objects and museum pieces to reveal their relationships to one another. Another example is in the construction of historical accounts based on analysis of a number of source documents. A further example is of city tours that convey the narrative of the city and the points of interest within it. Such cultural and historical narratives are complex. They cross between the realm of tangible objects and physical locations, to the online world of surrogate representations of mixed media types, to the conceptual space of the stories that tell of relationships between them. Sometimes, as in a museum, objects can be moved to reflect underlying relationships and sometimes, as in the case of cultural points of interest across a city, they cannot.

	Virtual	**Physical**
Fixed	**Web-based historical inquiry** from mixed media resources, including documents, images, videos, audio files.	**Cultural visits**, such as museum galleries, museum grounds, city tours.
Movable	**Content curation** of web resources, for example using Storify (https://storify.com/)	**Curating museum exhibitions**

Table 1.1. Narrative building scenarios across different dimensions.

Table 1.1 explores some examples of narrative building scenarios across the dimensions of virtual vs. physical and fixed vs. movable. The scenarios presented are by no means exhaustive, but are given as they are used throughout the thesis in exploring the research questions that will be introduced towards the end of this chapter.

To highlight the role of narrative within these scenarios, within each it is possible to assume either the perspective of an author - actively constructing a story across objects to produce some output - or that of a reader, actively making sense of a story that is already authored. Narratives have certain properties and expected patterns that make communication through stories possible. The reader can use their own expectations of a narrative to understand what the author is trying to convey (Schank, 1990). These principles, described in more detail in Chapter 2, include properties of coherence, and the use of internally consistent time periods, places, people and themes. Thus, in the scenarios of Table 1.1, an author may narratively organise objects according to common themes, or so that events associated with an objects – such as their creation date – occur chronologically. In doing so, the relationships between objects can be more easily understood by the reader. In the process, the author themselves develops their own understanding of the relationships between objects. Each of these scenarios will now be explored in more detail.

1.1. Narratives from Fixed Virtual Objects –Web-based Historical Inquiry

As an increasing amount of content becomes available online, people are able to rely less on single sources of information for learning. Instead, it is possible to access a number of resources related to a topic and to build up a picture based on multiple different perspectives. One case where online resources are found to be particularly useful is in conducting a historical inquiry, in which a learner assesses a range of available evidence in order to form their own opinion about some historical events. The idea is that the learner takes on the role of a historian, actively constructing history, rather than passively reading a single historical account and memorizing the facts (Hicks et al., 2004a and b), thus gaining a deeper understanding of the inquiry topic (Brush and Saye, 2008). The output of a historical inquiry is a narrative output, such as an essay, in which the learner explains their conclusions and indicates how the evidence they assessed supports their point of view.

Many original source documents have been digitized in some form and made available online as a resource for teaching history. These might include scans or transcripts of original documents or letters, photos of buildings or objects, or archival video or audio records. In addition, it is possible to find additional material on the Internet related to a historical inquiry, including second hand accounts based on another author's interpretation of the historical period. Methods to support students in undertaking a historical inquiry tend to focus on verifying the veracity of such accounts, within a more general inquiry framework that prompts the learner to ask and answer historical questions from source evidence. Examples, such as the SCIM-C strategy (Hicks et al., 2004) or GATHER (Anderson-Inman and Kessinger, 2000) are described in detail in Chapter 2.

Such models follow from earlier examples of models to support an inquiry-based method of learning in the domain of science. Such models aim to support students in generating hypotheses to support the collection and interpretation of data. Examples include the model proposed by White et al. (1999), which was later adapted by Scanlon et al. (2011). Such models have formed the basis of a number of online tools to support the application of scientific inquiry, such as WISE (Slotta, 2004) and WeSPOT (Mikroyannidis et al., 2013). In addition to scaffolding the inquiry process itself, these tools provide support for parts of the inquiry process that students might find difficult, such as the ability to move backwards and forwards between different stages of the inquiry and reflect on work done so far, to more practical tasks such as data collection and visualization. A more detailed view of both models and tools is given in the section on related work.

Some methods exist to support a web-based inquiry process. One example is HSI: Historical Scene Investigation (Swan and Hofer, 2005), which provides a framework for creating historical inquiries around web content and using the metaphor of a crime investigation file. Another example is WebQuests (Dodge, 1995), which offers an approach for structuring web-based search tasks usually to be completed as collaborative group-work. These are generic and not targeted specifically towards historical inquiry, although they could be framed around a historical inquiry task. These approaches are described in more detail in Chapter 2. Unlike the tools to support scientific inquiry, the available tools that were investigated as part of this thesis were not found to provide practical support to the undertaking of the inquiry process or the construction of narrative outputs from web content.

There are particular issues that a student might face in undertaking the inquiry. One particular drawback of historical inquiry is that, unlike the single perspective 'textbook' account of history, the information needed to construct a story across the different sources and different types of information is not always encountered in a coherent narrative order. Whilst teachers may organize links and resources in a certain order to reflect their own understanding, or according to some temporal or thematic relations, this may not reflect the understanding of the learner as they try to construct their own narrative. When assessing multiple narrative sources, the information contained in one or more sources might be either repeated or contradictory and the organization of the same story events within different narrative accounts can differ. Learners develop strategies for dealing with this when they are dealing with paper resources, such as re-organising the content to better reflect their understanding of how information is related (Leat and Nichols, 2000). However, this is not always facilitated with online content.

The proposal of this thesis is that tools to support historical inquiry should, in addition to supporting the process of the inquiry and the critiquing of sources, also provide support for narrative building processes across a set of mixed resources. The following section explores how ideas of museum curation could inform an approach to this.

1.2. Narratives from Movable Physical Objects – Museum Curation

In designing museum exhibitions, curators – or groups of museum professionals acting in the role of a curator - select and organize objects to tell stories across them (Davies, 2010). The curation process involves inquiry-based research in which the overall purpose of an exhibition is decided, sometimes termed the 'grand narrative' of the exhibition (Rowe et al., 2002). This question frames the subsequent selection and interpretation of objects for inclusion in the exhibition. Curators will begin by considering which artworks or artefacts fit within the overall narrative and what is known about them. This process involves researching not just archival material related to the objects, but also the historical context. In effect, it is partly a historical inquiry process. Curators group and organize objects to create different parts of the overall story, for example grouping objects of the same type, grouping artworks from the same time-period. As part of the curation process, curators typically produce story text to explain these groupings. When objects or artworks are placed in the museum, this text is often placed at the entrance to a room in which the grouped objects are contained, whilst individual object stories are used to explain more detail about each piece in turn (Bearman, 1991).

Finally, the exhibition narrative is displayed in some form. The common mode of presentation is through the placement of objects within a physical museum space, although virtual galleries, handouts, catalogues and audio tours are alternative narrative possibilities. In the case of the physical exhibition, when planning where objects should be placed, there is some consideration given to the physical layout of the space. Curators design exhibitions with a space in mind, and normally have some intended path that a visitor will follow in order to encounter a museum story in their intended order. Of course, in some cases it is not possible to perfectly align the narrative of the objects with the path of visitors. Objects may be too large, or a room may be too small to fit every related object into it.

Therefore, one proposal for supporting historical inquiry from online resources is to understand whether there are sufficient similarities between the processes of historical inquiry and the processes of museum curation, that it becomes possible to frame historical inquiry as a curation task. This thesis will aim to provide evidence to support the realization of this idea as a curatorial inquiry learning cycle for historical learning across diverse web resources. This work is described in Chapter 4.

1.3. Narratives from Movable Virtual Objects – Online Content Curation

A number of tools currently exist for curating online content. The aim of such tools is to help people in making sense of the vast amount of information available online and to help in the longer-term management of the content (Liu, 2010). These tools are often also referred to as social curation tools when they are targeted towards the curating of social media items, such as Tweets, Facebook posts or YouTube videos.

Liu, 2010, identifies seven types of curatorial activities that occur in museum curation and which are proposed to be important also in online curation. These can be summarized as finding, organizing, preserving, selecting for presentation, storytelling, presenting and teaching. However, the processes supported by individual content curation tools can vary considerably. Some favour certain types of content or activities over others. Pinterest supports the collection, annotation and sharing of images under thematic headings. Storify[1] supports the collection of a wide range of different media types, including photos, videos, web pages and social media such as individual tweets. These can then be annotated and curated into stories, using additional text to provide context and linking between objects. Zhong et al. (2013) refer to both these types of activity as *structured* curation, as opposed to *unstructured* curation where users indicate a preference for a particular web resource, e.g. by 'liking' it.

If historical inquiry can be conducted as though it were a process of structured curation, then such content curation tools may offer one possible solution towards collecting, interpreting and organizing web content for the inquiry. The question that needs to be

[1] https://storify.com/

asked is to what extent such tools offer appropriate support across all required parts of a historical inquiry process.

This thesis offers an analysis of a number of content curation tools that were popular at that moment and which are representative of the types of content curation tools that are available. It should be noted that new tools frequently appear and existing tools regularly disappear.

Based on the analysis of museum curation practices, combined with the assessment of content curation tools, the QrAte tool for supporting a curatorial inquiry learning cycle across online resources will be proposed. This can be found in Chapter 4.

1.4. Narratives from Fixed Physical Objects – Cultural Visits in Outside Space

As discussed earlier, museum curators facilitate the understanding of museum narratives by organizing objects to reflect the underlying story. This is possible because most museum artefacts are portable. Visitors are then guided through the space to experience this intended narrative. However, once the exhibition is in place, whilst it is still possible to find alternative narratives, it is no longer possible to arrange the objects to reflect them. Instead, in the small space of the museum, the strategy is commonly to provide alternative routes through the museum, delivered through human, audio or self-guided tours, i.e. where the visitor simply picks for themselves where to go, possibly according to some thematic or other interests.

A number of museum technologies have been created to support these types of self-guided tours. They generally work on the principle of discovering what people are interested in, or identifying what they have been stopping to engage with in the museum, then guiding them to related items. Examples of these tools are discussed in Chapter 2. However, some research appears to suggest that even in the small space of a museum, visitors are reluctant to follow suggestions based on finding interesting narratives (Sharples et al., 2013) but prefer to follow the paths physically afforded by the museum layout.

When cultural visits occur in an outside space, the distances between objects are often much larger. The sorts of cultural objects found in outside spaces take a diverse range of forms ranging from large artworks and sculptures, to entire buildings, to parks, gardens and even natural features such as trees that have a historical significance.

The outdoor cultural scenarios that are considered within this thesis are those in which the objects that are being visited are not necessarily all part of a single coherent narrative, but those in which narrative connections do exist. One example is of modern art and sculpture in the grounds of a museum. These are often larger pieces that are acquired over time and which are placed with reference to the best setting for the piece (and available space) and not organized to tell a story. Another example is places and points of interest within a city, which may develop over significant periods of time. In these presented scenarios it is not possible to reorganize objects, places, or natural features of the environment to reflect the narrative. In this case, understanding the narrative connections between items and their associated stories becomes harder.

One possibility, where the order of objects in the physical space doesn't naturally align with the underlying story, is to prompt people to take the narratively coherent path amongst a set of objects or places. This is one common approach taken for developing technology for tourists. Some examples can be found in Chapter 2. But if it is the case that visitors are unwilling to follow prompts in the museum that cause them to deviate from the natural route through the museum building, it seems likely that a similar, or even greater, reluctance would be found when the physical distances to travel were much bigger. It follows that the sorts of technologies developed in a museum are even less likely to be appropriate to support outdoor visits. This assumption is backed up through the studies conducted by Tintarev et al (2010) and Mitchell and Chuah (2013) who studied tourist behavior whilst using personalized tour recommender technology. These studies are described in Chapter 2.

Whilst it seems reasonable to suggest that people are still interested to discover the narratives that exist, there is little research to be found that evaluates whether or not this is actually the case.

1.5. Relationship to the Decipher Project

Such insights into the museum process of curation and the importance of organizing content has been found not just from literature (as reviewed in more detail in Chapter 2), but through the experience of working with museum professionals as part of the Decipher project. This project was aimed at developing tools and methods to support museum curation. The project worked with curators, archivists and education specialists to understand the process of creating museum narratives.

The outcome of this work was a tool called Storyscope (Wolff et al., 2013) through which museum objects could be described, collected into museum dossiers and then used to create exhibition narratives, in which the objects were organised to tell stories. These narrative organisations of content could then be used to guide the creation of a museum exhibition, specifying text for wall panels, for the labels of individual objects and determining how objects should be arranged within and between rooms to convey the intended story of the curator. Narratives could also be output as microsites which would present the organized content in the form of an interactive website that a visitor could navigate online.

In the museum, the process of selecting, interpreting and organizing content is one through which the curator increases their own knowledge about the exhibition and the relationships between the objects that they consider including within it. Whilst the objects end up in a fixed order, from the point of view of the curator the process of being able to reorganize objects facilitates not only their own process of narrative construction, but also their ability to convey this narrative to their audience. The work described within this thesis is partly built upon work within Decipher, in particular the insights gained from working with curators. Where the Decipher project was looking at curation practices in a museum, this thesis explores how curation can inform construction of narratives outside a museum context, either when organizing objects online or when objects *cannot* be moved to reflect narrative order.

1.6. Research Framework and Thesis Outline

The above scenarios prompt the overarching question of this thesis:

> *'How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?'*

Table 1.2 identifies a research framework and further questions through which this will be explored. This table summarises the structure and contents of the remainder of the thesis.

<table>
<tr><td>Main research question (MQ1)</td><td colspan="3">How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?</td></tr>
<tr><td colspan="4">Four sub questions have been identified for answering the main research question. Each question is aligned to a study that can be found in a later chapter of the thesis.</td></tr>
<tr><th>Question no.</th><th>Question</th><th>Chapter</th><th>Description</th></tr>
<tr><td>Sub question 1 (SQ1)</td><td>How can methods from inquiry and from the curatorial practices of museums inform narrative construction?</td><td>Chapter 4 – QrAte tool for historical inquiry</td><td>Using a combination of literature review, examples from museum practice and drawing upon theories of inquiry-based learning, this chapter develops a model of curatorial inquiry to support the undertaking of an online historical inquiry in which primary and secondary source materials are analysed and organized to create a new historical account. This model aims to understand how narratives may be constructed across diverse resources through a process of curation.</td></tr>
<tr><td colspan="4">Chapter 4 lays the foundation for and motivates the remainder of the thesis, which focuses on narratives that occur in a physical space, where the objects are fixed and therefore cannot be curated. The questions associated with these further chapters are now described.</td></tr>
<tr><td>Sub question 2 (SQ2)</td><td>How can construction of narratives be supported in a physical space when objects cannot be organized to reflect the underlying narrative?</td><td>Chapter 5 - IMMA sculpture garden</td><td>This chapter introduces a model that distinguishes the physical narrative that is experienced when visiting multiple points of interest in a physical space from a conceptual narrative that provides a coherently ordered story across the same objects. This model is used to support the design of three subsequent studies that explore how narratives are experienced by a ‘reader’ across a physical space of discrete objects, when the objects cannot be moved. This chapter describes the first of these studies, investigating how people</td></tr>
</table>

			navigate amongst artworks in the grounds of a museum and how they engage with stories about the objects on a mobile device.
The IMMA study reported on in Chapter 5 raises additional questions about how navigation decisions are made and how they can be supported. The following studies were conducted in parallel to investigate these issues of support prompts and to investigate 'in the wild' behaviour. Each had strengths and weaknesses in what they could show, which will be discussed in the methodology chapter (chapter 3).			
Sub question 3 (SQ3)	What effect do different types of prompt have on decisions made about navigating multiple points of interest?	Chapter 6 – Virtual Tourist Trail	This chapter introduces a controlled study aimed to elicit detailed feedback from a small number of participants as to what motivates their navigational decisions when they are acting as tourists and visiting multiple points of interest and how different types of prompt may or may not influence their choice.
Sub question 4 (SQ4)	What is the relative importance of physical and conceptual proximity 'in the wild' for tourists navigating multiple points of interest?	Chapter 7 – Foursquare Analysis	This chapter analyses data from Foursquare social media check-ins to identify common patterns of behaviour and to identify whether these can be related to physical or conceptual proximity, or to something else.

Table 1.2. Research Framework

To summarise, this thesis will describe two models to support narrative navigation and construction across sets of objects that are either real or virtual and which are either in a fixed or movable order. The first is a model of curatorial inquiry, combining ideas of museum curation and online content curation, to support a historical inquiry task from online content. The second is a model that aims to understand navigation in both physical (across the city) and conceptual (across the story) space. This second model will be used to support the design of three experiments aimed to discover to what extent visitors are interested in understanding the narrative relationships between objects in sculpture gardens or cities and to what extent this is reflected in their chosen paths between objects.

The remainder of the thesis is structured as follows. Chapter 2 presents the related work that provides the context for this thesis. Chapter 3 introduces the methodology for answering the research questions. The following four chapters describe the main body of work conducted in the thesis, which have already been highlighted within Table 1.2. Finally, the discussions and conclusions can be found in Chapters 8 and 9, in which the findings from the work will be revisited in the context of the two proposed models and some scenarios put forward.

2 UNDERSTANDING THE RELATIONSHIPS BETWEEN NARRATIVE, INQUIRY LEARNING AND CURATION PRACTICES ONLINE AND IN A PHYSICAL SPACE.

2.1 Introduction

This chapter will explore previous research across several areas that are of importance to the understanding of how people engage with cultural and historical objects in both an online and a physical space. Of key interest is the role of *narrative* in providing coherence to everyday experience. Inquiry-based learning will then be discussed as a starting point for understanding how and why scientific inquiry models have been adapted to support historical inquiry, with a particular focus on conducting historical inquiry across multiple web-based resources to produce narratively coherent outputs. This will lead into a discussion on the similarity between historical inquiry processes and online 'social' and physical museum curation process, including a review of technologies to support museum visitors. This in turn will lead to a discussion of more general tourist behaviour outside the museum and the technologies that are developed to support tourist navigation across multiple points of interest. Next, the chapter will explore how tourist behaviour has been analysed via data on sites such as Foursquare. The chapter will conclude with a discussion of how the related work has informed the remainder of the work presented in this thesis.

2.2 Narrative

People learn from an early age how to communicate their experience through the telling of stories (Schank, 1990). The importance of narrating experience as stories and the role of stories in creating memories was further explored by Schank and Abelson (1995). Taking as a starting point this idea that stories are important to everyday thinking, it becomes useful to understand how to differentiate between the content of a story and how the story is told. This distinction was made by Chatman (1978) who proposed the model of narrative shown in figure 2.1.

2.2.1 STORY CONTENT

Chatman's model indicates that story content takes the form of the events (what happened), the characters (who were involved) and the settings (a time and place in which story events are occurring).

This distinction by Chatman allows that a story, comprising of a number of events, can be manifested in different forms, such as written story, play, or on the screen. The organization of story events - such as which to include, which to omit, what order to present them in – can also be changed to reflect different interpretations of how events were related, or to create dramatic effects. For example, changing the chronological ordering of events is often used as a plot device, such as showing the outcome of a murder and then showing events leading up to it, in order that the audience themselves can try to work out 'whodunit'. However, it should be noted that neither the concept of *drama,* nor of *plot,* is reflected in Chatman's model.

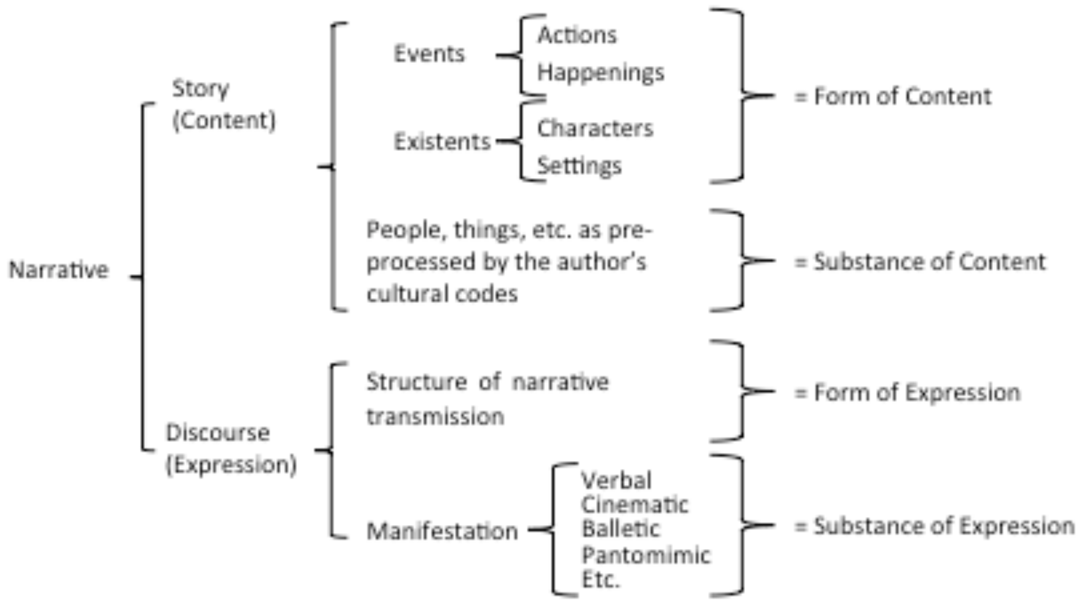

Figure 2.1. A model of narrative structure (reproduced from Chatman, 1978).

2.2.2 PLOT STRUCTURE

Narrative plots arrange story events in certain expected patterns. In its simplest form, Aristotle noted in his c. 335 BC work *Poetics* that a story should have a beginning, middle and end. A more complex plot structure was proposed by Freytag in 1863. This model introduces the idea of a plot producing dramatic effects, through rising action which reaches a climax before the tension produced leading up to this climax is dissipated before the narrative ends.

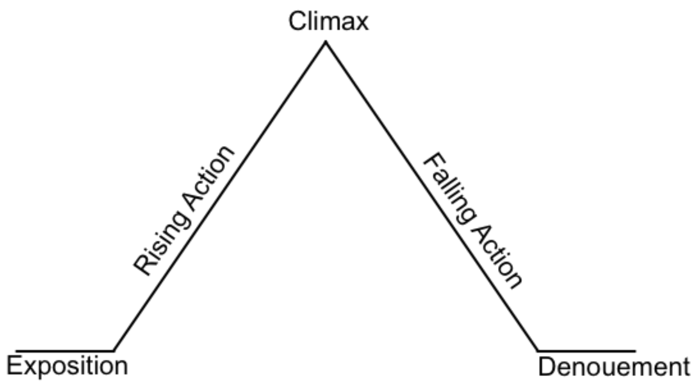

Figure 2.2. A representation of Freytag's pyramid.

Brooks (1996) identifies a more complex narrative structure, based on earlier work by Branigan (1992). This structure is comprised of the following narrative primitives:

- speaker introduction – introduction of the character from whose viewpoint the story will be told
- character introduction – introduction of other characters involved in the story
- conflict – introduction of an obstacle to be overcome
- resolution – overcoming the obstacle
- diversion – a moment of tension relief, possibly comedic, which is incidental to the plot
- ending – overall resolution to the narrative

The introduction of story characters within this definition of plot differs to the model of Chatman, such that in Brook's view they appear as part of the narrative structure (i.e. the discourse) whereas Chatman incudes characters as part of the story content.

Wolff et al. (2004) specify an alternative structure in which characters are not central, but where conflict and resolution are the most important aspects. In this scheme, the following elements can be used to create a plot, with sub-conflicts, comedic events or sub-plots being optional to a complete narrative.

- theme introduction
- conflict and resolution attempts
- postcompletion events
- sub-conflicts and comedic events
- sub-plots
- themes

The first three elements of theme introduction, conflict resolution attempts and postcompletion events must occur in the above order within a coherent plot structure, whereas the optional elements can occur at any time. Wolff et al. (2007) used this narrative structure to organise clips across several series of a television show and compared this against content that was randomly ordered. They showed that recall was significantly better for the narratively ordered content.

This suggests that people, even from a young age, are primed to remember facts when they are presented within a narrative framework. Thorndyke (1977) similarly demonstrated that when stories were created from story grammars, they were more easily recalled than those in which the story structure was mixed up. A further study by Garnham et al. (1982) found that recall could improve for the mixed up story content if referents were put in to facilitate the readers to orient themselves within the narrative.

2.2.3 STORY THEMES AND SETTINGS

In addition to the story events, character and settings offered by Chatman, there is also a view that a story has one or more themes. Tomashevsky (1965) posits that a theme (plus sub-themes, or motifs – smaller units of a theme) is essential to the coherence of a narrative. Theme gives a context to the story that can help interpretation. It may encompass a backstory that is shorthand for a set of events that have occurred, without knowledge of which the current events of the story are harder to understand. For example 'Word War II' or 'crime drama' can be story themes.

The theme lends coherence to the story, allowing it to make sense whilst moving around in place and time. Genette (1983) refers to *thematic or geographic syllepses*, which provide context to those stories and their events that cannot be placed in time or which do not follow a strict chronology. Conversely, a story that takes place in a single setting might play around with themes. One example of this is a soap-opera that occurs in a fixed location and time-period, but which explores the lives of multiple characters, some of whom never really interact with each other and are linked only through the place they each inhabit. However, a change in both theme and setting is much harder to understand: at some point, it becomes a different story altogether. Walker (1999) explored the importance of understanding the setting and theme through the reading of the hypertext narrative 'Afternoon' by Michael Joyce. In a hypertext narrative the reader is given free choice on which order to visit story components, which are small units containing just a few coherently organised story events. By reading these in an unstructured and random way, Walker identified that it is easy for the reader to become disoriented within the text, due to an inability to comprehend the basic temporal ordering of story components. This situation could be improved by a 'first' reading of the story in an author intended order that gives the basic storyline in a temporal order. Thereafter, additional markers within each story component - that indicate the *when*, *where* and *who* of the component - allow the reader to situate it within the basic storyline derived from the first reading.

Similarly, Hargood, Millard and Weal (2011) compared using thematic principles to find photographs for illustrating short stories with using story keywords for photo selection. They found that the thematically photo-annotated stories were rated higher for coherence than when images were selected by a keyword.

2.2.4 NARRATIVE COHERENCE

To summarise, a story consists of a set of events that can be organised and presented through different media, presenting different viewpoints across the same story content.

Plot structures can be applied to organise content. Many plot structures that are defined include ideas of drama and conflict. Taking Chatman's model of narrative, it is possible to organise content without imposing either plot, or drama. However, narrative structure, along with setting and theme, provide coherence to a set of story events that has been shown to improve story comprehension and recall. For this reason, these types of narrative principles are often used to structure and present story-based (i.e. event-based) materials into more coherent and therefore more meaningful and memorable narrative presentations. Some of these are now described.

2.2.5 AUTOMATED NARRATIVE ORGANIZATION OF UN-RELATED STORY MATERIALS

Murtaugh's (1996) Automatist Storytelling System explored the possibility for dynamically generating personalised presentations. It used keyword annotation of content, along with narrative and editing principles encoded by a narrative engine, to dynamically alter a narrative in response to user action. Based on this, Murtaugh created Contour and Dexter both of which select some multimedia resources (e.g. videos, documents or images) for a user based on previous choices made within that particular narrative presentation. The user is thereby guided through the narrative whilst having the ultimate choice as to the materials they wish to view.

Scene-Driver (Wolff et al., 2004) created narrative presentations of movie-clips taken from the children's television program, Tiny Planets. Each unit of content was described according to narrative properties of the clip and coherence was maintained by ensuring that all orderings of the clips adhered to acceptable plot templates. The user would interact via a domino-like interface, so that they would have the sense of playing a game to unravel the entire narrative. Each domino depicted characters from the show and the left and right sides would match the previous and next clips, respectively. An algorithm was used to generate the possible games and specify the dominoes that could be provided to the player to ensure that no matter what tile they placed, there would always be a clip to play and that there was always the possibility to see a complete narrative by playing the tile-set.

The work of Rocchi and Zancanaro (2003) includes directorial techniques in the presentation of narratively structured graphical material. Annotated images are chosen from a library to reflect the content of a verbal commentary. The system then provides a plan structure for synchronising the images with the audio soundtrack, including suggestions as to which sort of transition (e.g. camera angle and movements, editing technique between shots) should be used between one image and the next.

The above systems differ in the extent to which they aim to produce dramatic stories compared to informative presentations of factual content. However, in each case the narrative is constructed by the system, based on properties of the available content. The user's role, while not completely passive, has only minimal impact on the direction that the story can take.

2.2.6 DEFINITION OF NARRATIVE

Based on the review of narrative above, this thesis subscribes to a definition of narrative that aligns with the model outlined by Chatman in which the events of the story are separate from the way that the story is told. The authoring process thus consists of the reorganization of events for different narrative purposes, such as dramatic effect or to aid understanding of the relationship between events. In other words, this definition of narrative can be equally applied to both the creation dramatic plots and to the organization of content according to narrative principles, where the goal is to create coherence by subscribing to expected practices of narrative generation.

2.3 Inquiry-based learning

In recent times, there has been a move towards allowing students to explore and learn in a hands-on way, rather than simply being passive recipients of learning content. This is based on the idea that an active learning experience is more beneficial to a learner than a passive one. This method has its roots in *constructivist* theories that hold that learning occurs through a process of active construction. Dewey (1933) originated the notion of *experiential learning,* which puts forward the idea that learning should be situated within a real-world context and experience rather than reliant on rote learning of a collection of facts. This stance was later shared and restated by Jerome Bruner (1991) who proposed the idea of discovery learning, in which learners discover knowledge for themselves. Similarly, Piaget's (1973) theory of constructivism focused on the idea that knowledge is constructed from experience using two processes: of *assimilation,* in which new experiences are assimilated with old, and *accommodation*, in which past knowledge is reframed in the light of new experiences.

These ideas have led to the development of *inquiry-based learning* methods. In inquiry-based learning, students become active investigators answering questions. When talking about inquiry-based learning it is first useful to discuss what is meant by "inquiry". Inquiry means to pose questions and to search for answers to those questions. "Inquiry-based learning" refers to a learning approach in which students are actively encouraged to ask questions during the process of learning and to seek information to help them answer those questions. It is an on-going and flexible process of discovery using available facts and gathered evidence.

An inquiry-based learning process can be structured in a multitude of different ways and applied to different topics. Some attributes of the inquiry task may be varied according to the skill of the student. Such attributes include the *flexibility* with which a student can diverge from the original question set by the teacher, the way in which the inquiry is *assessed* (teacher assessment, self-assessment, peer-assessment) and the level of *self-direction* - whether the student undertakes the entire process themselves or if there teacher direction and guidance (Wells, 2001).

In a truly *open inquiry*, a student decides their own topic for investigation and undertakes it entirely by themselves. This requires a high level of analytical skill. Choosing a topic, selecting a driving question with a suitable scope and then locating and interpreting appropriate sources, or devising appropriate methods for data collection, are skills that most students must first learn (Wallace et al., 1998). Novice inquiry learners require help in developing skills of inquiry (Kirschner, Sweller & Clark, 2006; Mayer, 2004). Therefore, most teachers use a form of *Guided Inquiry*: which provides a framework and some instructions for conducting the investigation. The teacher assists by setting the questions and suggesting how the investigation might proceed. Students often work in groups. *Scripted inquiry* is a special form of guided inquiry where in addition to the support of the teacher, guidance is provided through specially formulated scripts (Conole et al., 2008; Dillenbourg and Jermann, 2007; Martin-Hansen, 2002).

Other considerations that aren't intrinsically linked to the inquiry process but which can also make a task more or less complex include:

- *Scope of the task:* is the topic of interest only within the context of the curriculum, or does it have some greater importance? Is the task self-contained or very open-ended? How many sources of evidence are likely to be needed to address the task?
- *Complexity of acquired knowledge*: will the task lead to simple fact learning, or will it reveal relationships between diverse subjects and lead to deep understanding of complex concepts?
- *Learning Materials*: *w*hat types of sources are used for evidence? Physical or online resources, or a mixture of both? Single or multiple media types? Objective or subjective data?

- *Output*: how will the student present their findings? Will they have a choice, or is the output determined by the teacher or by the nature of the task?
- *Individual or group work*: do students work alone or in groups? Can findings be combined at the end of a task to answer a more complex question?

2.3.1 THE INQUIRY CYCLE

The goal of inquiry learning is for the student to gain knowledge within a particular subject area through completing an experiment and also to learn the scientific method through which experimentation can occur. These are, respectively, termed the *transformative* and *regulatory* processes of inquiry by de Jong and van Joolingen (1998). In order to scaffold the learner in applying and learning the scientific method, a number of different models have been defined that can be used to frame the inquiry process. Generally speaking, inquiry is realised as a cycle in which initial problem identification informs the subsequent gathering of evidence required to answer the question. Once evidence is gathered, it must be interpreted with respect to the initial question. Sometimes, this leads to a new cycle of inquiry. Several different version of this cycle have been proposed.

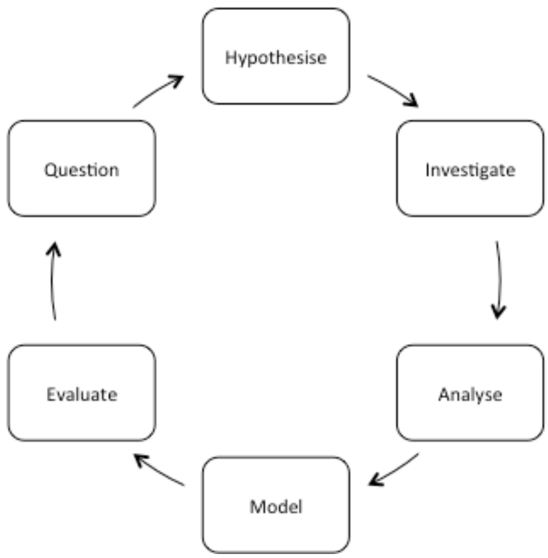

Figure 2.3. An inquiry cycle (reproduced from White et al., 1999).

Figure 2.3 shows an example of an inquiry cycle by White et al, (1999). This inquiry goes through the following stages:

- Question- formulate the research question
- Hypothesise – identify some hypotheses related to their question
- Investigate – design and carry out an experiment to collect data with relation to their question
- Analyse – analyse the data and look for patterns
- Model – identify a causal model to characterise conclusions
- Evaluate – explore the limits of the model and identify any new research questions arising.

The model of Scanlon et al. (2011) shown in figure 2.4 extends the idea of the inquiry cycle to reflect the iterative nature of inquiry, in which the learner can transition between any different phase of the inquiry as needed, with no clearly defined start or end point (figure 2.4). This model was proposed in the context of independent learners conducting personal inquiries. By contrast to the earlier model of White that identifies 6 stages of the inquiry process, this model proposes 8 distinct phases and also makes explicit all possible transitions between the stages of the inquiry. The extra stages reflect a distinction between ‘planning’ and ‘conducting’ evidence collection during the investigation stage. It also makes explicit the sharing and discussing of findings from the analysis prior to reflection on the outcomes.

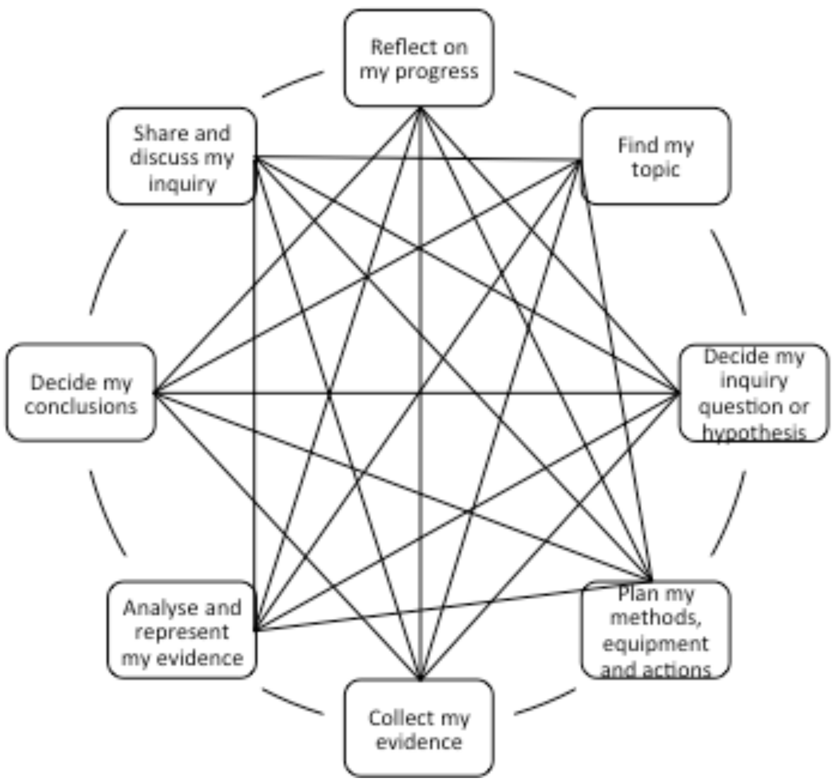

Figure 2.4. Scanlon’s iterative inquiry cycle (reproduced from Scanlon et al., 2011).

2.3.2 SCIENTIFIC INQUIRY

The origins of the inquiry-approach are in scientific experimentation and this is the domain within which models have generally been developed and evaluated. The following sections explore some models for supporting scientific inquiry.

2.3.2.1 WISE

The Web-based Inquiry Science Environment (WISE) (Slotta, 2004) offers a platform through which teachers and students can define and undertake scientific inquiries, combining scientific experimentation with knowledge derived from the web. The WISE approach encourages students to work collaboratively, planning and conducting scientific inquiries. Each inquiry can include interactive simulations, data visualisation tools and models of scientific phenomena, along with other multimedia materials. Students are prompted to follow an overall inquiry process of Predict, Observe, Explain and Reflect (POER) and to produce coherent narratives explaining key events from their inquiry to explain their findings. Students are encouraged to respond to differing interpretations of scientific findings through critical feedback of their own work and the work of others. The approach was designed to integrate scientific inquiry with the skills of information problem solving (IPS) in which students search, select and gather information from the web to provide additional knowledge for understanding and interpreting the outcome of their scientific experimentation. Information Problem Solving (Eisenberg and Berkowitz, 1990: Eisenberg, 2004) is itself a form of inquiry in which identifies six stages (called the Big6) of information searching from online sources, these being:

- **Task Definition** - Define the information problem. Identify information needed
- **Information Seeking Strategies** - Determine all possible sources. Select the best sources
- **Location and Access** - Locate sources (intellectually and physically). Find information within sources
- **Use of Information** - Engage (e.g., read, hear, view, touch). Extract relevant information
- **Synthesis** - Organize from multiple sources. Present the information
- **Evaluation** - Judge the product (effectiveness). Judge the process (efficiency)

Even though WISE incorporates the framework for information seeking, WISE does not actively support these different processes.

2.3.2.2 WeSPOT

The weSPOT tool of Mikroyannidis et al. (2013) provides flexible support for structuring an inquiry, allowing teachers and students to adapt to different models of inquiry. For each inquiry that is set up in WeSPOT, it is possible to configure the task to reflect alternative versions of an inquiry, for example either the 6 stage model of White et al. (1999) or the 8 phase version of Scanlon et al., 2011. Learners are able to move backwards and forwards between different stages of the inquiry, recording their findings.

WeSPOT is designed to encourage co-learning. Students can work individually or collaboratively. Within a single inquiry, students are able to see the work of other people undertaking the inquiry and to comment on their ideas, questions or outcomes.

2.3.2.3 nQuire and nQuire-IT

The nQuire science inquiry tool was developed to support scripted, personal inquiry in and outside the classroom (Mulholland et al., 2012). The nQuire approach encourages personalisation of existing inquiries, or construction of new inquiries, so that students can undertake investigations that have some personal relevance to them. The student is guided through the different phases of an inquiry, but at the same time they are able to easily visit the other inquiry steps to help with planning out future activities, or reviewing what has been done. nQuire aims to support the regulatory processes of the inquiry by allowing teachers to script the learning flow through the individual activities associated with the inquiry and to monitor this while the inquiry is being undertaken. The outcomes of activities are notes, questions, data, graphs and presentations. Transformative inquiry processes are supported through linking of outputs between one stage of inquiry and another, for example linking data collection and analysis.

Based on the nQuire approach, nQuire-it missions are designed to encourage participation in citizen science (Herodotou et al, 2014), in which the public collaborate with scientists in scientific research. The nQuire-it approach is delivered as a series of missions that a learner can choose to join and participate in. Missions can be one of three types. In a

Spot-it mission, learners collect data from their own neighbourhood that they can then see in combination with data collected by other people in other locations. Users can comment on their own and other people's data. Sense-it missions task learners with capturing and sharing sensor data through mobile phones. Win-it missions set scientific challenges to be completed within a specific time frame and with prizes for the winner. Using nQuire-it the learner does not always explicitly see the different stages of an inquiry, but through undertaking the missions they are experiencing the inquiry process. If they create their own inquiry they are encouraged to think more about the different processes, for example the question they are asking, what data they want people to collect, and how it will be analysed.

2.3.3 HISTORICAL INQUIRY

Inquiry-based learning methods are now becoming common for other classroom subjects. This section focuses on the teaching of history through active reconstruction from multiple sources of information, using a process of *historical inquiry*. Historical inquiry refers to the process of analysing all available historical resources and then using the evidence obtained from them to reach a conclusion.

In the classroom, history has traditionally been presented as a set of 'known' facts, neatly packaged into stories, which students have learned by rote. However, such stories offer an interpretation of facts and events that may reflect a bias of the author. In addition, the validity of the facts upon which a story is based may be in doubt due to the nature of the sources used to reconstruct events (White, 1973). Historical accounts are often constructed from third person testimonies, sometimes ignoring conflicting sources and filling in blanks with a “best guess” where necessary. Organising facts into an easily recognisable plot structure and presenting it as a story may make it easier for the reader to comprehend, but students who learn from these pre-packaged accounts are learning only the perspective that the author chose to present, with no option to see the other interpretations that may exist.

Thus, in the classroom, historical inquiry is a means of learning history in which the student looks at various sources for themselves and then uses the evidence they find to construct their own interpretation of what happened (Newmark, 1997). The student *becomes* the historian, exploring multiple perspectives then choosing their own point of view, rather than learning from the output of another historian (Yang et al., 2007). Hicks et al, (2004b) point out that through this process, the student acquires some skills of a historian, such as chronological thinking, historical analysis of cause and effect and discussion, debate and persuasive writing. Brush and Saye (2008) studied the effect of learning history through active inquiry compared to traditional methods and discovered that students who did the active inquiry demonstrated deeper engagement and understanding of the content.

Historical inquiry blends narrative data sources - such as written documents, letters and historical accounts - with other types of historical source materials, such as photographs, artefacts and even scientific data. Data sources can be categorised as being either *primary* or *secondary* sources of information. Primary sources are artefacts from the actual period of history and may include original documents (that could provide eye-witness versions of events), objects or creative works. A secondary source provides an interpretation across one or more other sources, which may be primary sources, or which may themselves already be secondary sources.

2.3.3.1 The relationship between historical inquiry and narrative

In undertaking an inquiry across historical sources, the student must assess the available information and construct from it a version of history that they believe is supported by evidence from the sources that they found. Essentially, the student uses the sources to identify a set of historical events and then to propose how events are related to each other. In doing so, the student must resolve bias and inaccuracies in both primary and secondary sources, being critical of sources, looking for corroborating or contradictory information and dealing with missing information. The output of a historical inquiry is commonly a narrative one, in the form of an essay explaining a period of history in terms of the available evidence and in terms of the student's own interpretation and organisation of historical events. Polkingthorne (1998) and Bruner (1991) go further by suggesting that narrative is intrinsic to the *process* of inquiry, in that it is an essential tool for constructing and assimilating knowledge. Thus, rather than being simply the end-product, narrative can assist the student in interpreting and relating bits of information during the process of the inquiry.

To summarise, in learning history it is essential to understand and reflect upon different perspectives and interpretations across the same set of resources. Primary and secondary sources come in many different media and formats, many of which are themselves narrative. The sources sometimes contradict each other, may contain bias and inconsistency and not every event in history is known. Therefore, the same set of resources can lead to multiple different accounts and it is not always possible, or even necessary to reach a consensus opinion. This distinguishes historical inquiry from scientific inquiry, which as previously discussed tends to be more objective. Models of historical inquiry are adapted to reflect this change. There are several different models to support historical inquiry. These are outlined below.

2.3.3.2 The SCIM-C Strategy

The SCIM-C strategy (Hicks et al., 2004a; 2004b) is intended to guide students through historical inquiry tasks and assist in interpreting historical sources and dealing with multiple accounts of the same events. This method consists of five stages, each supported by a set of analysing questions. The first four stages are applied to a single source. The final (corroboration) stage is only applicable when several sources have been viewed. The stages and questions (reproduced in summary form from http://www.historicalinquiry.com/scim/) are:

1. Summarising: note the explicitly available information. There are four specific questions associated with this stage, they are:
    a. *What type of document? (e.g. letter, photograph)*

    b. *What specific information, details and/or perspectives does it provide?*
    c. *What is the subject/purpose?*
    d. *Who were the author and/or audience?*
2. Contextualising: understand the historical context of the resource, e.g. differences in speech or culture. Questions are:
    a. *When and where was the source produced?*
    b. *Why was the source produced?*
    c. *What was happening within the immediate and broader context at the time the source was produced?*
    d. *What summarising information can place the source in time and place?*
3. Inferring: what inferences can be drawn based on the initial fact-finding in the source. Questions are:
    a. *What is suggested by the source?*
    b. *What interpretations may be drawn?*
    c. *What perspectives or points of view are indicated?*
    d. *What inferences may be drawn from absences or omissions in the source?*
4. Monitoring: reflect on assumptions made and the reliability of the source under scrutiny. Questions are:
    a. *What additional evidence beyond the source is necessary to answer the historical question?*
    b. *What ideas, images, or terms need further defining?*

   c. *How useful or significant is the source for its intended purpose in answering the historical question?*
   d. *What questions from the previous stages need to be revisited in order to analyse the source satisfactorily?*
5. Corroborating. Look for similarities and differences, identify gaps in evidence, spot contradictions and then start to draw conclusions based on a synthesis of the evidence. Questions are:
   a. What similarities are there between the sources?
   b. What factors could account for these similarities and differences?
   c. What conclusions can be drawn from the accumulated interpretations
   d. What additional information or sources are necessary to answer more fully the guiding historical question?

The SCIM-C approach focuses on interpretation of evidence and does not provide guidance for asking historical questions, selecting the sources, or in constructing historical narratives based on the conclusions drawn from analysis of each resource.

2.3.3.3 GATHER

The GATHER model of historical inquiry (Anderson-Inman and Kessinger, 2000) proposes six stages. These are:

- **G**et an overview. Understand the general topic and the historical context.

- **A**sk a probing question. Ask a question that will require an investigation involving analysis of several sources.
- **T**riangulate the data. Triangulate data from different types of sources (primary, secondary and expert opinion)
- **H**ypothesise a tentative answer. A working hypothesis should provide the basis for further investigation (e.g. to find facts to support a proposed hypothesis)
- **E**xplore and interpret the data. Look for the data to support the hypothesis. If the data does support it, then move to stage 6 (record and support conclusions) otherwise revise the hypothesis and repeat.
- **R**ecord and support your conclusions. Create a historical narrative and argument demonstrating the conclusions that have been reached.

The GATHER approach mimics a standard inquiry-based learning model but applies it specifically to historical inquiry. Within the *triangulation* step, reference is made to the primary and secondary sources of inquiry. A third type of source is proposed, that of expert opinion. This model does not provide specific support for triangulating data or assessing sources, though something like the SCIM-C approach could be used in this stage.

2.3.3.4 Information Problem Solving (IPS)

Comparisons can be drawn between historical inquiry and the previously described Information Problem Solving (IPS), which scaffolds a web-based inquiry process). Both go through many of the same stages of defining an inquiry question, seeking and critiquing resources and producing and evaluating some output. Therefore, IPS could be specialised to support a historical inquiry that is conducted purely across web-based resources, by placing additional emphasis upon categorising sources as primary or secondary sources of information and critiquing them, for example applying a SCIM-C strategy.

2.3.4 TOOLS FOR HISTORICAL INQUIRY

This section discusses a number of web-based tools that have been developed to support students in conducting a historical inquiry.

2.3.4.1 Historical Scene Investigation (HSI)

HSI: Historical Scene Investigation (Swan and Hofer, 2005) is a U.S. based website where teachers and students can access a number of historical inquiries. Learners are given a case file containing a set of source documents, some supplementary files aimed to help the learner analyse evidence and a set of inquiry questions. Documents are filled in and handed in to the teacher. Therefore, HSI does not provide the functionality to store the outcomes or workings of a student's inquiry.

2.3.4.2 WebQuests

WebQuests (Dodge, 1995) are structured web search tasks most commonly around historical inquiry topics, and usually completed in groups. They generally contain an introduction and a set of instructions to learners, but beyond this are completely flexible in both structure and presentation. To adhere to the original WebQuest approach, a number of criteria should be adhered to. For example, the task should replicate a genuine real-world inquiry scenario and should be primarily based around web-research (although other sources of information can be included). A number of tools exist to support the creation of Webquests, such as QuestGarden, or downloadable author templates from the WebQuest site. However, the WebQuest approach is essentially independent of these tools. Consequently, the approach does not provide practical support for students to undertake a WebQuest although the Webquest approach could easily be incorporated into tools that do.

2.3.4.3 The Mystery of Sam Smiley

The Mystery of Sam Smiley (Hicks et al., 2004b) is essentially a lesson plan that is intended to teach students the basic skills needed to conduct historical inquiry. Students are given a set of sources (witness statements, list of physical evidence etc.) about the disappearance of a character called Sam Smiley and they have to use the evidence to construct a theory about what happened. It is based on the premise that by giving students a fairly constrained task, with pre-constructed materials, that requires a certain skill-set to solve, students will perform better on future inquiry tasks. The skills and strategies that the students should develop from the Sam Smiley task are to explore historical questions, find useful information from a variety of different sources, identify and reconcile conflicting accounts and finally to create a narrative account which can stand up to scrutiny in light of the available data. Students should understand that different interpretations may exist of their data and that conclusions might change in the light of more evidence.

To summarise, there are several web-based tools that support the creation of historical inquiries and which reflect the underlying processes of the inquiry. Through using these approaches, students may gain insight into processes of historical inquiry that could further help them in conducting their own inquiries in the future.

The Internet is a good resource for teachers and students to use for locating both primary and secondary sources for undertaking historical inquiry (Newmark, 1997). Web resources can be used in conjunction with knowledge from other sources such as textbooks, supplementary materials or by the teacher themselves (Singleton and Giese, 1999). However, research has shown that students can encounter difficulties when using diverse web resources as part of learning. Kuiper et al. (2009) identified that, during a web-based collaborative inquiry task, students had problems with integrating different information sources and with recognising information that was relevant to the question they were answering, favouring instead to try and find a resource with the exact answer to their question rather than piecing it together themselves. Walraven et al. (2009) found that students put more focus on searching for information than for assessing the validity of the resources they found. Students typically gave only a cursory evaluation of the resource, not checking, for example, who was the author or when a page had been updated.

However, the tools described offer little practical support to students in terms of working across the possibly diverse set of resources, which could contain different media types, mixing for example video resources with photographs, diagrams, data and narratives. In other words, they do not support the practical aspects of both interpreting and constructing narratives across diverse web content.

2.4 Curation

These processes of selecting, interpreting and organising content can be conceived as a curation task. The following sections explore two different types of curation, firstly curation of web-based content and secondly museum curation of physical objects.

2.4.1 CONTENT CURATION

Content curation is the process of collecting web content related to a theme and organising it in a meaningful way. Social curation tools are tools that are aimed towards the facilitation of curation of web content. Popular examples of social curation tools are *Storify* (https://storify.com/) and *Pinterest* (https://uk.pinterest.com/). Storify facilitates the collection of diverse web content into a scrap book that can be glued together with story text to be presented as a story across multiple web sources. Pinterest allows people to set up topic spaces within which they can collect content under this thematic heading.

The extent to which social curation tools meet the needs of a historical inquiry tool will be discussed in Chapter 3. Another place in which selection and curation of content is important is in the museum.

2.4.2 MUSEUM CURATION AND EXHIBITION DESIGN

The role of the museum is changing. In the past, museum practice was focused around the collection and preservation of artefacts of perceived historical importance. In modern society, the museum functions as a place for both formal and informal learning, particularly where social inclusion is seen as being of importance to the museum (Hooper-Greenhill, 2004; O'Neill, 2006; Monk, 2013).

In a museum, objects are displayed alongside interpretative information, in the form of text panels, images, background documents or audio information (Bearman, 1991), which tell stories about where an object was made, who by, or what significance it has (Pearce, 1995). Peponis et al. (2003), in an analysis of museum exhibitions, used the term *narrative* to refer to an arrangement of exhibits and their associated information into a sequence that yields more complex insights than could be derived from exhibits individually. A museum narrative provides information as to the manner in which the individual exhibits can be conceptually related.

Museum narratives are constructed through the process of *curation.* Much as the role of a museum in society has changed, so has the role of the curator. O'Brian (2005) identifies that whereas in the past the role of a curator was as custodian over museum objects, it has now become an active process of construction, including activities of selecting, assembling, and arranging objects for the purpose of conveying an idea, or story, to an audience. Davies (2010) examined the role of collaboration in exhibition design and found that in modern museum practice, the role of curation is often performed by a collaborating group of museum professionals. In particular, the defining of the overall narrative for an exhibition was undertaken commonly by a group of professionals internal to the museum. Dean (1996) describes this exhibition design as a cyclical process. The project starts from an initial idea. As the exhibition completes, new ideas are generated for future projects.

Rowe et al. (2002) distinguish between the "big" narrative of the exhibition and the small vernacular narratives associated with it. These small narratives may originate from the visitor, triggered by something in the exhibition. For example, the visitor recalling a personal experience related to an object or event of the exhibition. Museums may also use small narratives themselves to help visitors to relate to the bigger narrative. For example, presenting the (possibly fictional) story of a character who lived at a certain time in order to bring it to life.

As with other types of narratives, the presented story can be varied to reflect alternative perspectives or reveal a more in-depth version of a narrative. For example, the museum catalogue typically presents more detail and backstory about artists and their lives than the physical exhibition. This reflects how visitors engage with content in each of these contexts – in the physical space it is assumed that it is the object itself that visitors most want to engage with (Hermann, 1999).

Museum narratives can take multiple forms, including physical exhibitions, catalogues, hand-outs, audio tours, guided tours, cultural events, education outreach activities and museum web spaces. The museum narrative organises objects to reflect and provide evidence for the underlying story. For example, a biographical exhibition of an artist's work might organise the work according to the timeline of the artist's life, which additionally could have thematic groupings according to the different periods of their life. Thematic exhibitions collect and display artefacts related to an overarching theme, for example '20th century modern art'. In the physical exhibition space, the layout of a museum is used to guide the ordering of objects to reflect the narrative structure. For example, placing objects related to a distinct period of an artist's life together in one room, e.g. 'early life and career' and ensuring that the room most likely to be visited next contains the objects related to the period of life immediately following this.

Hooper-Greenhill (1999; 2000) distinguishes between interpretation that is done *for* the visitor and that which is done *by* the visitor, based on their cultural backgrounds and existing knowledge. In this way, Hooper-Greenhill views learning within museums as a constructivist process - one that is mediated through the activities of the museum to organise and present objects to reflect a particular interpretation. This view is supported by Walker (2006), who extends Mott et al.'s (1999) proposal for narrative-centred learning environments into the physical space of the museum, viewing a museum as a place for active narrative creation, an act which facilitates visitors to remember more from their visit. Similarly, Monk (2013) proposes that the role of a curator should be to facilitate experiential learning and to prompt critical though, reflection and action. Studies into visitor behaviour in a museum reveal that typically a visitor engages with only between 20-40% of an exhibition, giving the possibility that the visitor does not experience the full narrative as intended by the curator. Rounds (2004) proposes that instead of this being viewed as a dysfunctional strategy that negatively affects the potential for learning from the museum visit, the curiosity-driven visitor can be shown to be fulfilling their own personal goals, if not that of the museum. In this respect, Allen (2004) identifies the difficulty that museums face in providing a balance between supporting an inquiry-based constructivist learning approach where learning occurs through hands on interaction with exhibits, and that of fulfilling the role of educator and ensuring that visitors leave having learned something. Allen refers mainly to science inquiry and exhibits of a science museum, however a similar principle holds in terms of supporting a historical inquiry process of learning across a number of museum objects or artworks. Peterson and Levene (2003) describe this process of visitor interpretation across trails of museum objects as *navigational learning*. Visitors both *enact* and *edit* the trails. Enactment refers to how the objects are encountered in a specific order within the physical space, whether this is a prescribed path or something more free form. *Editing* refers to the process by which visitors research and pre-plan their visit and how they reflect upon them afterwards, re-enacting them and editing them to something that has more personal meaning or is more coherent.

To summarise, museum professionals select and organise museum objects to tell stories. In an exhibition, the physical layout of the museum space affects the structuring of the narrative and to some extent the natural order in which items will be viewed. Museum professionals are aware of and make use of these physical affordances to guide visitors on an intended route, although museum visitors are free to choose different routes and to engage with only items that they are interested by. The visitor experience can be viewed as a process of personal narrative construction, in some cases aligning with a narrative as intended by a curator and in other cases deviating from it, for example if visitors divert from an intended route or draw upon their individual knowledge and cultural background in interpreting what they see. Narratives assist visitors to remember their visit.

2.5 Narrative construction across a physical space

To support the idea that visitors create their own interpretations of and across content, a number of tools and methods have been developed that aim to guide and inform cultural visitors, either in a museum environment or during other tourist activities such as when visiting a number of points of interest on a city tour. Mobile technology offers opportunities for developing applications to support cultural visitors. Lamsfus et al. (2015) highlight research that shows that in the case of city visitors, at least, the possibilities to use mobile technology during a visit increase the likelihood of independent (non package tour) travellers to make decisions on which attractions or restaurants to visit during the trip, rather than in a pre-planning stage. Overall, while there are some differences between museum narratives and city narratives (which will be discussed later in Chapter 7) the approach to guiding users in understanding the relationship between objects or places are based on similar principles.

2.5.1 TECHNOLOGIES TO SUPPORT CULTURAL VISITS IN CITIES AND MUSEUMS

Zydeco (Cahill et al., 2011) aims to support what it terms as 'nomadic scientific inquiry' in museums – technology supported inquiry 'on the go'. Rather than tour planning, the Zydeco tool allows users to plan an inquiry around a museum visit, by framing in advance what sort of concepts and objects they hope to find. Students then collect and annotate photos of evidence that they discover during the visit, and use this collected information to formulate an answer to the inquiry question - an activity that can take place after the visit. The aim of Zydeco is to provide some structure towards learning from a museum visit in an unstructured environment where students have freedom of choice over where to go and which objects to engage with. Zydeco does not, however, provide any information about the museum, nor help students to find objects that are related either to each other or to their inquiry.

Walker (2006) proposes capturing the narrative that a visitor experiences as a digital learning trail (as originally proposed by Peterson and Levene, 2003) that the visitor can later reflect upon and readjust, omitting or including objects from the narrative. The rationale is that by capturing the visitor experience as a narrative, the visitor will be prompted to recall more about their visit at a later date.

Lim and Aylett's (2007) mobile tour guide constructs stories to engage visitors by merging both user interests with different 'personalities' of tour guides that a visitor can choose between to experience different stories about the same places or historical events. The story is constructed from both a selection of facts related to a selected story event or fact - such as the number of deaths caused by the dropping of the bomb on Hiroshima in 1945 - and also the ideological perspective of the automated tour guide, such as appending a moral judgement on the dropping of the bomb.

mi-Guide (Linge et al., 2012) supports visitors by providing rich multimedia content associated with museum visits, supported by tour details that can be accessed from and navigated through the device. Mi-Guide tours are not adaptive or personalized. All of the content provided has been pre-authored.

The CHIP (Cultural Heritage Information Presentation) approach aims to personalise the experience both online, in a virtual museum, and off-line, supporting activities of a user pre and post museum visit and providing continuity of visit between these two different modes of engagement (Wang et al., 2009). There are two components, a tour wizard that helps a user to create a museum tour in an online space that can then be mapped to the museum and an adaptive mobile guide for use in the physical museum (van Hage et al., 2010). This tour route is based on specified user preferences - either artworks that they have rated positively, or artworks that are within the top 20 recommended - and also takes into account the physical layout of the museum, planning the tour to take the most efficient route through suggested objects. The system then tracks a visitor's actual path through a museum. If the visitor deviates from a planned route, for example they stop to look at something additional that has caught their eye, the system recognizes this and adapts the subsequent tour to take into account their new interest. CHIP aims to support the "virtuous circle", which is a term used (Barry, 2006) to describe the relationship between virtual and physical content in a museum such that the visitor has a seamless experience between the two modes of engagement. This in turn supports the visitor in better recall by activating prior knowledge. The evaluation of CHIP focused on evaluating the efficiency of the algorithm for computing a coherent route through the museum and on discovering whether the tool helped either novices or experts to gain better insight into their art preferences.

Noguera et al. (2012), describe a mobile app that makes recommendations to a user based on their current location and their stored preferences. The system can recommend restaurants, points of interest, cafes, bars, and accommodation. Recommendations are visualised on a 3D map and also shown in a list. The distance from the visitor's current location to a recommended place is used to select between recommendations that are otherwise rated the same. Whilst recommendations are calculated from the visitor's location on request, each place, the tool does not generate tours.

The GUIDE system (Cheverst et al., 2000) assists a city visitor in planning a tour, selecting attractions to visit based on their interests or highlighting the key points of interest and then in finding best routes between selected locations. GUIDE integrates data about the attraction's opening times and the best time to visit to avoid queues and uses this as part of the tour planning. If a visitor does not want to visit the attraction suggested by GUIDE they could choose a different one from the tour. The suggested tour reconfigures itself if circumstances change, for example visitors stay longer than the tour had planned at a location and would not therefore have time to complete the original route. GUIDE also supports tourists to explore the city as they choose, using the GUIDE system as and when they think they need it. In this case, visitors can choose to see either information about the location they are currently in, or some generic information about the city. Evaluation of GUIDE revealed that visitors liked the location-based information but did not like to be too constrained in what they could access. At the same time, where there was a lot of flexibility this was also confusing to participants.

To summarise, there are a number of mobile phone apps to support visitors during a visit to a museum or a city. One type of app aims to support the visitor in capturing more information about their visit, for the purpose of later reflection or to answer an inquiry (e.g. the Zydeco system, or Walker's narrative trails). However, these apps are independent and contain no information about the place that is being visited.

Others types of app make use of location-based technology to provide more in-depth information about the location in which the visitor is currently standing. Examples include mi-Guide, Lim and Aylett's storytelling guide and Noguera et al. (2012) mobile recommender app. These provide rich information about individual points of interest or objects in a museum, or information about what is nearby, but give no indication of how places or objects are related to one another.

A further type of app aims to create and adapt personalised tours, which offer suggestions as to where to go next based on a number of parameters. These include long-term preferences stored in the user profile, current location, available time, attractions already visited, user mobility, weather, transportation mode in use, user's mood and social environment. Parameters are often used in conjunction with an optimisation algorithm to plan a route based on travelling the shortest distance, in other words, some variant of the Travelling Salesman Problem (Gavalas et al. 2014).

Such personalised tour apps assume that tourists will be willing to deviate from a more 'natural' route through a museum or city in order to experience a more coherent narrative. However, some recent research into the use of mobile apps - both in museums and across the city - is beginning to question the extent to which tourists are willing to follow suggestions. Kramer et al. (2007) evaluated two different modes of a Dynamic Tour Guide. In Explorer mode, the app provides only location-based information on request and a list of close attractions. In Planner mode, the device creates a personalized tour based on some initial preferences such as tour duration. Evaluation of Planner mode revealed that not only did users rarely complete a planned tour (on average seeing only 50% of proposed tourist sites), they also visited a number of unplanned attractions. Users who undertook sightseeing supported by Explorer mode visited on average 3 more sights, walked further and spent longer.

Sharples et al, (2013) evaluated a museum audio guide system 'CAGE' which aimed to reveal conceptual connections between paintings in a gallery through audio guide descriptions, in cases where the connections were not immediately afforded by the layout of the museum. Evaluation of the system revealed that while visitors could be prompted to glance towards related items mentioned in an audio guide, they did not walk across the gallery floor in order to visit pieces in a narratively coherent order.

Tintarev et al. (2010) compared tourist recommendations for popular sites against personalised tours with less popular sites included that were tailored towards the visitor's special interests. Both the popular tour and the personalised tour included five POIs, however, the participants were free to ignore a recommendation and to visit other sites that they were interested in. The outcome of the evaluation seemed to show that whilst in both cases visitors would visit in the region of 5 sites during their visit, they were more likely to visit the recommended sites on the 'popular' tour than on the personalised tour. However, the participants on the personalised tour were not instead visiting popular sites, but rather places they came across themselves.

A similar outcome was found by Mitchell and Chuah (2013), who developed and evaluated the Travel Teller system for mobile story telling across tourist sites. This used theme to propose how to organize stories from traveller's photographs and also provided prompts for where they could go next to continue their story. The system was designed to recommend places for visitors to go to allow them to experience and tell stories on the move. They discovered that visitors showed a strong preference for spontaneous independent travel. Travellers were often less interested in reaching a recommended destination than in some of the things they might discover on the way, which they felt had an element of surprise. Sometimes the places they found along the way would suggest new goals that conflicted with the original recommendation. Visitors were rarely prompted to follow recommendations of the mobile tour guide in pursuit of a story, but instead preferred to restructure their experiences into a story after the fact.

Hornecker et al. (2011) propose a 'Serendipitous City Guide' that is designed to support these types of un-planned tourist activities instead of pushing an itinerary and pre-defined route onto travellers. Visitors pre-select places that they are interested in. The system then notifies visitors through a vibration alert when they are near places they have expressed an interest in.

Taking all of the above into consideration, it would seem that museum and city visitors may be interested in the narrative connections between artefacts and places of interest, but not to the extent of making detours through a physical space to encounter places in a narratively logical ordering. In other words whereas most mobile tour guides try to prompt users to *enact* an entire narrative, it seems possible that users do in fact want to use freedom of choice in selecting where or what to visit from one point of interest to the next, but with support towards the editing of the experience into a narrative afterwards in order to facilitate recall. In other words, drawing together some of the context-free functionalities for more free-form tourist visits of Cahill and Walker to support narrative construction and inquiry, with location-based information of the other mobile guides. As Lamsfus et al. (2015) argue - the real benefits of mobile technology for tourism will be realised when it is used to support the creation of stories through a combination of personal, situational, environmental and technological data, and to support flexible, spontaneous travel decision-making. However, from the above it appears that information about the relatedness of POIs is rarely provided as part of mobile tourist apps, particularly when the visit is across a city rather than in a museum. This limits the possibilities for facilitating the user's understanding of narrative coherence across the physical space.

2.5.2 ANALYSIS OF TOURIST BEHAVIOUR THROUGH DATA

Where the above propose and evaluate methods to support cultural visits through the use of mobile technologies, it is also possible to discover trends in tourist behaviour by looking at data that reveals what tourists actually do in practice. One approach has been to look at data collected through social media apps such as Foursquare, through which people ‘check-in’ to places that they visit, such as POIs, restaurants, music venues, cafes and bars.

Users often check-in to the places they visit in their local area. One reason that users check into places is as a way of informally sharing location for the purpose of planned or spontaneous meetings between friends (Frith, 2014; Lindqvist et al., 2011). Through Foursquare data, it is possible to identify patterns of local’s habits through their repeat visiting behaviour. In one example, Noulas et al. (2012) has combined popularity of a venue (as identified from Foursquare), with distance between locations and an individual’s past behaviour in order to predict where the user will go next. Cheng et al., 2011 analysed a set of Foursquare check-in data (and also check-ins from some other sharing sites such as Gowalla) that had been posted via Twitter and which included both time and geo-tag information. Through this information, they were able to identify periodic behaviour amongst user’s movement patterns, for example returning to the same place on a weekly or monthly basis. Similarly, projects such as Livehoods (Guan and Chen, 2014) have used Foursquare data to identify clusters of places where the same people commonly check-in, offering the possibility that newcomers to a city could use this knowledge to find places where like-minded people go. However, these data analyses are focused towards understanding how existing locals use a city. They would offer little support for a tourist with limited time to visit the city. Also, Lindqvist et al. (2011) identify that, in fact, Foursquare users tend not to check-in to places they visit frequently. Instead, Foursquare users prefer to check-in venues that they consider to be of interest and worth noting (Patil et al., 2012). Therefore this data can also be used to understand common tourist behaviour, such as to reveal which attractions are most popular in a city that attracts a lot of tourists and what sort of routes a traveller is most likely to take around a particular town or city. This in turn can be used to drive tourist recommendations.

Yuan et al. (2013) and Hsieh et al. (2012) both use Foursquare data to derive information that is then used to provide recommendations to visitors. Yuan et al. (2013) use both temporal and spatial data to make POI recommendations, based on an assumption that visitors are more likely to visit nearby POIs and that some types of venue are more popular at certain times of day than others, for example libraries are more likely to be visited during the day and bars at night. Hsieh et al. (2012) mine Foursquare check-in data to generate time-sensitive tourist trails amongst a set of POIs, such that different routes are suggested from the same starting point at different times of day.

To summarise, Foursquare data can be used to reveal patterns of behaviour around different types of venues in a city. These might be places that are frequented by locals or they may be tourist sites in the area. Potential applications of analysis of this data towards tourist applications include identifying the places that 'locals' are more likely to visit, thus providing information to tourists that they would not necessarily find in a guidebook, or providing recommendations to tourists based on the activities of past visitors to the area. Similar to the tourist guides explored in the previous section, little analysis has been done on how the places visited might be related conceptually. Instead, the tourist applications from Foursquare data focus more on the practical spatial and temporal constraints of navigating around the city in the available time (and with respect to opening hours) and visiting the popular locations.

2.6 Summary

This chapter has explored the role of stories and the principles of narrative in supporting the construction and understanding of the relationships between a diverse set of objects. Museum experts organise objects to tell stories, as they understand that this creates a more coherent and memorable visitor experience. Museum curation is conducted through a process similar to that of a historical inquiry. Therefore, historical inquiry across a set of mixed media resources might be supported through similar tools and methods to those that support curation. This idea is explored in Chapter 4 of this thesis, which proposes a model of curatorial inquiry to support online learning from historical sources.

Museum curation and exhibition design are also important when considering how people experience cultural narratives in the physical space of a museum. When objects can be organised to reflect a story it is easy to guide visitors to experience objects in a narratively coherent order. This chapter has explored a number of museum and cultural guides that aim to improve visitor experience by finding and directing them towards objects and places that they might find interesting based on conceptual similarity to their current location, or based on stated interests. However, some studies, such as Sharples et al, (2013) and Mitchell and Chuah (2013), indicate that despite potential benefit to the visitor in terms of creating a more conceptually coherent experience, they do not always want to follow the recommendation. Analysis of typical tourist patterns from Foursquare data indicates that this may be due to a preference for visiting places based on physical proximity or popularity, rather than conceptual similarity. These findings will inform the development and evaluation of a model to support tourist visits that more closely align with tourist preferences. This work is outlined in Chapters 5, 6 and 7 of this thesis.

3 METHODOLOGY

In Table 1.2 (chapter one), a framework was introduced for investigating the research questions. This table explains how the research questions map to the studies that will be described in chapters 4 to 7 of this thesis and outlines two models that will be developed to support the answering of the research questions. This current chapter revisits the ideas introduced in Table 1.2 and explains the methodology, the choices made and the use of the models in more detail.

3.1 Model of curatorial inquiry

Sub question 1 asks:

> *How can methods from inquiry and from the curatorial practices of museums inform narrative construction?*

A model of *curatorial inquiry* was developed to find out how it might be possible to support learners in working from online virtual resources. The aim of the model was to explore the idea that assisting learners to manipulate content to reflect a narrative organization can help them in using the content to answer questions. The purpose of the model was to allow an exploration of the similarities between the processes of museum curation, online content curation and the undertaking of a historical inquiry from online resources. The model was developed from practice, based on a review of literature on narrative theory, inquiry-based learning – with a particular focus on historical inquiry - existing tools for content curation and the curatorial practices of museums. There was also an assessment of existing models and tools that have been developed to support both scientific inquiry and historical inquiry, to see what could be learned from these examples and to identify gaps.

There were certain limitations to this approach, notably that it did not involve stakeholders, such as teachers or students, in either the design or evaluation of the model. The generalizability of the model was increased through drawing upon established research both in the different domains within which an inquiry process is taken and also on alternative models and tools for inquiry within these domains. This was then used to inform the design of the model. The development of this model is described in more detail Chapter 4.

3.2 Model of physical and conceptual space

The second model was designed to support the creation of experiences that prompt engagement with both physical and virtual objects, where only the configuration of virtual objects can be manipulated. The model allowed the differentiation between the physical and conceptual dimensions of narratives created across tangible objects. This allowed exploration of the extent to which these dimensions are separate and exploration of how they interact in different narrative scenarios. The scenario supported through this model was that of cultural visits across a set of loosely related points of interest. The two specific cases that were evaluated were visitors exploring a number of artworks in the grounds of a museum and visitors exploring multiple points of interest across a city.

Unlike in the first case where the design of the model itself was used to address a research question, in this case the model has been used to support the design of a number of studies for answering sub questions 2-4. These are described in more detail.

3.2.1 ANALYSIS OF VISITOR PATHS THROUGH MUSEUM GROUNDS

Sub question 2 asks:

> *How can construction of narratives be supported in a physical space when objects cannot be organized to reflect the underlying narrative?*

This was explored through remote observation and analysis of user behaviour within a field trial that was developed in conjunction with museum experts. The model of physical and conceptual space was first used to construct a visitor experience within the grounds of a museum, in which visitors scanned QR codes next to objects in the grounds, which provided information via a web-page on their device about items or content that was either physically close or conceptually close. The physical path could be tracked by seeing what (if anything) they scanned next. Their conceptual path could be tracked by finding whether they followed the web-link on the device to the related content. If the conceptual information was influencing their movement in the physical space this could be identified through their scanning behaviour, such that instead of going to the next nearest art object they would go out of their way to visit a conceptually related piece.

Data was collected using Google analytics linked to QR code scanning and subsequent link access. This was used to recreate visitor trajectories in physical and conceptual space. A qualitative analysis was performed on this data.

Participants were self-selected. The QR codes were available next to objects in the museum grounds for the duration of the experiment and anyone in the grounds who had a mobile device with a QR code scanner and a mobile signal was able to scan the codes and access the materials on their device. In addition, participants were recruited through information placed on social media sites related to the museum. The notices invited people to visit IMMA and to take part in the trial by scanning QR codes with their mobile devices. Participants were free to turn up at any time and to scan only items that they chose. In order to capture additional information, a link to an optional questionnaire was also provided where visitors could provide some written feedback about the experience. This questionnaire could be completed at the time or at a later date, after the visit.

This experience was designed in conjunction with museum professionals from the museum itself. This introduced some constraints to fit within their brief. The goal of the museum experts was to understand how QR code technology could provide additional stories about artworks through a device and how likely museum visitors were to engage with the QR technology without prompting. The stories were created using Storyscope recommender components and microsite output that was developed as part of the Decipher project (for more details of Storyscope see Chapter 4).

This recruitment procedure limited the opportunity for experimenters to observe or actively engage with participants prior to the experience. This had the benefit that it reduced the potential for an experimenter to influence visitor choice and bias the results. However, it also reduced possibilities for collection of feedback and it was not possible to know who was taking part in the experiment. There was no Wi-Fi signal available for visitors, therefore they would need to have some data on their phone. This could bias the self-selection of participants to locals, who did not have to pay extra for their data. Overall, this could affect the generalisability of the results. A further limitation was that visitors could pass an object and engage with it without scanning the QR code and this would not be known since the participants were not observed.

The collaboration with museum professionals in designing the study provided additional support to the validity of the model from which the experience was conducted, such that it supported the creation of an experience deemed both relevant and interesting to visitors. It was also possible to gain additional insight into museum practice and the construction of museum narratives. This study is described in Chapter 5.

3.3 Understanding what influences visitors' navigation between points of interest in a city

Given the limitations of the study in the sculpture garden described above, two further studies were designed, in parallel, to address some of the problems and also to extend the approach further to allow the investigation of the following questions (sub questions 3 and 4).

What effect do different types of prompt have on decisions made about navigating multiple points of interest?

What is the relative importance of physical and conceptual proximity 'in the wild' for tourists navigating multiple points of interest?

Both studies were designed to understand what motivates people in their choices about navigating between points of interest when they are visiting a city for the purpose of tourism, whether it is physical proximity, conceptual proximity or something else. The first was a controlled lab study with a small number of participants where detailed feedback could be elicited and the other was a large scale analysis of visitor behaviour in three different tourist towns using Foursquare data to find common patterns of tourist behaviour in these towns. The controlled study was also intended as a bridge between the sculpture garden experience, where distances between objects were relatively small and the tourist town where distances to travel could be much larger. Since it was not practical within constraints of time and resources to scale up the sculpture garden experiment and conduct something similar in the tourist towns themselves, the controlled study was staged for participants as a tourist trip around Paris. These studies are now described in more detail.

3.3.1 ANALYSIS OF VISITOR BEHAVIOR IN CONTROLLED STUDY ON VIRTUAL TOUR

The model of physical and conceptual space was used to support the design of a controlled study with 4 conditions in which participants used a mobile device to scan QR codes attached to virtual tour sites in a single room. Each condition was designed to offer an alternative narrative experience in physical and conceptual space. The controlled study ensured that participants had a similar experience, to then make it possible to manipulate and compare between different conditions. In each condition, participants followed an equivalent procedure of visiting a series of twelve virtual tourist sites and scanning a QR code at each site. The virtual sites were designed to be both informationally and visually similar. There were two aspects to the experiment. In the first, the independent variable was whether the objects were organized in the physical space in a narrative or a non-narrative order. In this case, the information presented on the device was neutral. In the second aspect, the objects were presented in a non-narrative order in the physical space and the independent variable was whether the information on the device was designed to prompt a participant to visit items in a narrative order, or if it was designed to prompt the participant to think about how items were conceptually related. In both cases, the dependent variable was the linearity of the route taken by the participant in each condition.

Overhead cameras were used to film participants as they moved through the room. The use of overhead cameras provided a method to track visitor movements through the space without the physical presence of the experimenter, which could have inadvertently influenced participant behaviour. Recording the experience also reduced the possibility of experimenter error that could occur during live observation and facilitated the same data to be analysed multiple times if needed.

A qualitative analysis was performed on the footage from the overhead cameras. This traced each participant's route through the lab onto analysis sheets to allow for a comparison to be made between them and to define categories of behaviour in this space. It was not known what sorts of patterns would emerge so the finding of patterns were based on sorting (and resorting where necessary) the analysis sheets according to different characteristics that could be found there. More focused analysis of data where unusual behaviour is identified was conducted by mapping the user behaviour to the stimulus from the device, which was dependent upon the condition of the participant.

Data was also collected by two questionnaires, one which was completed before the participants had taken part in the QR scanning activity and one afterwards. Google questionnaires were used to present the survey to participants. In addition to standard demographics, the questionnaire consisted of both open and closed questions. Good practice for questionnaire design was followed in order to mitigate possible effects of bias from asking leading questions, over-constraining the range of answers or over-use of open-ended questions. A scale of standard Likert responses was chosen to elicit opinion on topics related to participants own tourist preferences. The use of Likert scales is well established for this purpose and is a familiar format for respondents. The Likert responses facilitate analysis across the set of participants. The analysis is objective although it was important to frame the questions in a way that eliminated the possibility of experimenter bias. Open questions were used when it was important not to prompt or constrain the possible range of responses, although the responses were harder to quantify and the analysis of open-ended survey questions may be subject to bias of the person undertaking the analysis.

Each participant was identified by a unique anonymous ID that was tagged to their questionnaire result and to their camera footage to allow the two to be related to one another. The data from the questionnaires was subjected to a qualitative and quantitative analysis, as appropriate.

20 participants (5 for each condition) were recruited through university internal email lists and using the noticeboard on the university intranet. Participants were able to schedule their slot using a freely available online tool for volunteer recruitment. There was no reward offered for participation. The participant pool therefore included mainly post-grad students, research and administration staff of the university.

Recruitment of participants from the university could affect the generalisability of results, as it is possible that undergraduate students and research staff travel regularly for conferences and may have additional tourist possibilities. Therefore, their views on tourism and tourist behaviour could be affected. Further, each condition had only 5 participants which also affects the generalisability of results.

No pilot study was conducted for the virtual tour, since the use of questionnaire is fairly well established and since the overall approach and technology were already used in the IMMA sculpture garden trial.

This study was subject to the standard ethics approval process of the university and was conducted in full compliance with the terms of the ethics approval. This included anonymisation of participant data and secure storage of data obtained through the questionnaire and from the overhead camera. Participants signed a consent form to indicate that they understood the scope of the experiment, how their data would be used, that they consented to being filmed and they understood the procedure for withdrawing themselves, and subsequently their data, from the study.

3.3.2 Analysis of visitor behavior through Foursquare Data

Finally, the model of physical and conceptual space was used to guide the analysis of data obtained from Foursquare, which is a mobile application through which it is possible to 'check-in' to a venue to indicate that a person has visited. This data is tracked by Foursquare on an individual level, which allows Foursquare to also provide, for any given venue, data about where people are most likely to check into next. This allowed the analysis of data from a large number of tourists. Tourist behaviour was analysed for three major tourist towns or cities in the United Kingdom. The set of venues to be analysed in each place was created using a standardized procedure to ensure consistency between them. This procedure is described in detail in Chapter 7. The data collected was Foursquare *next venue* data and venue popularity, as identified through *check-in* numbers returned via the Foursquare API for each venue. This was used to find where visitors to a town were most likely to travel to 'next' from selected locations in a town. Two distance matrices were conducted for pairs of venues in each town. The first showed physical distance, calculated by Google maps. The second showed conceptual distance, calculated using semantic similarity of the Wikipedia pages of each venue pair. These calculations are also described in Chapter 7. To allow comparisons to be made, it was important to ensure that the procedure to calculate distance was consistent for all venue pairs.

Analysis took the form of both a visual and a predictive analysis of the output to try to identify whether physical or conceptual proximity (or something else, such as popularity) was affecting visitor behaviour. The inclusion of popularity was informed by the review of literature across other Foursquare data studies.

There are possible limitations to this study since nothing can be known about what might be influencing visitor choice. However, Foursquare analysis allows the extraction of patterns of general behaviour across a large cross-section of the public. The choice of towns and venues was intended to optimize the probability that the majority of data being analysed was from people who are acting as tourists in the town. The inclusion of

Foursquare data analysis was intended to provide support for findings from more focused studies. However, there is also the possibility that the choice of towns for Foursquare analysis is not representative of tourist behaviour in larger cities, in other countries, or in places that are less compact and where there would be greater reliance on other forms of transport to travel between places.

3.4 Summary

A model of curatorial inquiry has been introduced, the design and development of which was used to further understand the processes that support the creation of narratives across a set of online historical resources. A second model is introduced that has informed the design of several experiments, each of which will evaluate some aspect of how narratives are encountered and understood in the physical world. A variety of methods, including Google analytics of QR code scanning, remote observation of tourists, questionnaire and analysis of Foursquare check-in data were used to find out what factors are influencing visitor choice of which places to visit from their current location. Overall, the outcomes of the four studies contributed towards answering the main question of the thesis, namely:

> *How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?*

Study 1 advanced understanding of how narratives are constructed online when objects can be moved to reflect a narrative order. Studies 2-4 advanced understanding of what types of narrative support the understanding of the relationships between objects when they are in a fixed order in the physical space and cannot be organised to reflect a conceptually coherent order. They further explored what strategies people use to discover the physical and conceptual relationships between objects. Study 3, in the controlled environment, prompted participants with different navigational prompts to see how this affected their behaviour. Study 4 analysed behaviour patterns across a large number of people and proposed two different factors – physical proximity or conceptual proximity - that could be influencing decisions about where to visit next, and assessed which one (if indeed either) most closely predicted their behaviour.

4 QRATE TOOL FOR HISTORICAL INQUIRY

As discussed previously, history is becoming more commonly taught through an active process of inquiry than a passive rote-learning paradigm. This is helped by an increase in historical content being digitized and made available online. This provides better opportunities for students to learn from multiple source documents, rather than a single textbook, and provides a new dimension to the teaching of history that teachers are keen to explore (Sandwell, 2008; Sexias, 2001). Using these sources, students can effectively become historians themselves and more easily realise that history can be viewed from different perspectives (Levstik and Barton, 2001).

4.1 The challenges of historical inquiry from primary and secondary sources

To be an effective resource for inquiry, source material must be integrated into classroom learning in the correct way (Sandwell, 2008; Barton 2005). Primary sources are original artefacts or pieces of evidence from the period of study. Younger learners, in particular, often struggle to understand historical context from a primary source alone. Also, primary sources may contain bias (Barton, 2005). Secondary sources are based on primary sources, but provide some additional context and interpretation. They may provide a clearer picture across the set of sources, but are commonly narrative-based and may present information from a potentially biased personal viewpoint. The next challenge for the learner is to find the relevant facts and events from amongst the sources, and to understand how they relate in order to construct a coherent narrative from the available evidence. This challenge is compounded by the potentially diverse nature of resources, which may include audio, video, images and text. Once the learner has identified data and proposed some relations, they must check their assumptions against the available evidence and either explain any contradictions or else rethink their ideas.

Colby (2007) conducted a number of studies that assessed students undertaking a historical inquiry from primary and secondary source evidence. Secondary sources were often narrative accounts. Students went through a fairly typical historical inquiry process which were described as:

1. *contextual beginnings* – background to the inquiry
2. *in-depth questioning* – setting questions for inquiry
3. *secondary and primary source analysis* – specifying that secondary sources are evaluated before primary sources
4. *student authorship* – write a historical account reflecting own perspective
5. *philosophical/argumentative analysis* – reflect on answer to inquiry

Through analysis of students doing the inquiry, Colby identified that students had difficulty in identifying the more objective facts and events from the rest of the rhetoric, particularly amongst the secondary sources. This caused difficulties for restructuring and reorganising into the new narrative account. For these reasons, Colby suggested that a good range of data for a historical inquiry should derive from a selection of both primary and secondary sources. Colby also notes that one of the biggest difficulties faced by a learner at this stage of an inquiry is to coherently express their chain of reasoning within the final narrative output and to demonstrate how the evidence supports their conclusions.

One possibility to overcome this problem is the ability to take the facts and events, as small units of data, to move them around and place them into different groupings and to situate them alongside the source data. This is demonstrated by Leat and Nichols (2000) who observed students manipulating slips of paper containing information required for solving a problem with the aim of understanding their strategies when solving the task from multiple sources of information. Students were given an envelope full of 15-30 slips of paper, each containing some facts, and (initially) one question to answer. Some facts were concrete trigger factors (visible phenomena and events relating to time and place) while some were abstract background factors, while some information was irrelevant. The students were tasked with using the information as resources within an inquiry-like task in which they selected and arranged facts to explain their answer to the question. Through observation of students, Leat and Nichols identified a number of stages that the students went through whilst undertaking the task, these were:

1. the display stage – familiarisation with the available materials
2. the setting stage – selection and organisation of data into groups, including creation of a ‘reject’ pile.

3. sequencing and webbing stage – identify relationships, either with causal explanations (sequencing) or multiple interrelationships (webbing). This is the stage which often leads to inferences being made and the first appearance of a hypothesis.
4. Reworking stage – this stage may involve placement of items from the reject pile and reworking of groups to form new sets and relationships.
5. Abstract stage – a reflection stage where discussion continues about the topic, but which moves away from working with the actual slips of paper.

The following aims to demonstrate how these processes might be supported by framing a historical inquiry as a curation task, in which the goal is to select and organise primary and secondary source evidence into a narrative presentation to support the conclusions of a learner's inquiry. It will first be demonstrated how the museum curation process aligns with historical inquiry, leading to the identification of a curatorial inquiry learning cycle.

4.1.1 MUSEUM CURATION THROUGH AN INQUIRY PROCESS

Through a review of literature on museum practice (see Chapter 2) and through engagement with museum professionals as part of the Decipher[2] project (Mulholland et al., 2013) it is possible to understand museum curation as a specialised type of art historical inquiry (Bakewell et al. 1998), which occurs in phases that themselves reflect an active inquiry process and which commonly results in a physical exhibition, in

[2] http://www.decipher-research.eu/

addition to other common exhibition narrative outputs. These processes are detailed below.

Research

The first stage is *research*, which includes forming a question/topic around which to build the narrative. This could be based on one or more objects that are available, or on the particular area of expertise of the curator, or a topic of interest to the local community (Dean, 2002).

Select

The curator begins a process of researching possible objects to go on display. This includes searching archival sources for primary documents related to objects that may or may not be selected for inclusion in the exhibition. These include items such as letters, newspaper clippings, or government reports. They also locate and research secondary sources, for example to find out more about the historical period, to study the work of other art historians in a specialist field related to the works, to discover more about the cultural context and to find possible interpretations of artefacts (Bakewell et al. 1998). From this research the curator selects, acquires or negotiates to borrow the objects to display, these being ones that somehow evidence the narrative that is being developed.

Interpret

The curator begins to develop interpretations of objects. As well as providing objective information, such as when an object was made, who by, what it is made of, the curator might add their own annotations, interpreting the object in the context of the narrative that is being developed, i.e. how it is related to other objects within the exhibition (Dernie, 2006; Hooper-Greenhill, 2004). Curators develop text that will go on wall panels next to individual objects as well as wall panels that explain how a group of objects are related, for example through a common setting or theme, or through relationship to one or more people (which in itself indicates at least a setting within the time frame of their lives).

Organise

Objects are organised to reflect the developing narrative. Curators choose how much of the individual object stories and over-arching main exhibition story to make explicit, in a way that is appropriate to the medium through which the narrative will be presented.

Present

The final stage of the process involves the *display and presentation* of a completed museum narrative, in effect sharing the story with a wider audience through one or more chosen media. For a museum exhibition, the curator will organise sections of narrative into a physical space, for example allocating parts of the story to different rooms. In a museum catalogue a similar organisation will take place into chapters. The physical museum exhibition will tend to foreground the objects whereas historical background is more likely to be found in detail in an exhibition catalogue.

4.2 Curatorial inquiry learning cycle

To draw these two ideas together, in terms of the process undertaken, there are direct comparisons between the phases of a historical inquiry and the phases of curation. This can be seen by comparing historical inquiry processes such as GATHER, or the process outlined by Colby (2007) – which in turn is comparable to the Information Problem Solving method - with the museum curation process previously described. In each case, there is a question that is answered through the selection and interpretation of a number of resources, and from which some sort of narrative output is produced to answer the initial inquiry question. In each case, resources that are surveyed (or an interpretation of them) may be included or omitted from the final narrative. While these models frame the overall process of inquiry, they do not offer support for activities that occur as part of each phase. The SCIM-c strategy offers some additional information to learners about activities they might undertake whilst analysing primary and secondary sources. Application of the SCIM-c strategy may help to overcome some of the difficulties identified by Colby with respect to identifying the objective facts and events contained within a secondary source. SCIM-c encourages learners to identify and note down important interpretations, inferences and omissions of the source. However, SCIM-c does not resolve all of students' identified difficulties in conducting historical inquiry across a number of sources. As mentioned previously, the other activities in which students might benefit from some form of support is in structuring a coherent narrative account.

It is now proposed that framing historical inquiry as a curation task may be of benefit to students. To understand why this would make a difference, given that there is so much overlap between the phases of both historical inquiry and museum curation, it is necessary to understand that in fact the goal of the inquiry is currently different in each case.

The goal of a historical inquiry is to understand and learn about history through the creation of a historical narrative, one that reflects the learner's individual viewpoint on history based on their interpretation of available evidence. Often, a historical inquiry output takes the form of an essay, although there is no pre-defined narrative form. The essay is an end result of learning. It is used by the learner to reflect on their understanding and may undergo several revisions. But once it is deemed complete it is often marked by a teacher and filed away.

In museum curation, the goal is to produce a narrative output, in the form of a physical exhibition, through which other people can both experience the curated form of the narrative output, yet also be facilitated in making their own interpretations. This is the constructivist approach identified by Hooper-Greenhill (1999; 2000) discussed in the section on related work. In this way, much of the focus on constructivist learning in museums is focused on this interpretation by the visitor as they actively engage with a narrated exhibition. However, the process of curating can itself be viewed as an active learning task, but one in which the result of a curators' own learning is an output that is carefully designed to prompt and facilitate the learning of others (Dean, 2002; O'Neil, 2006). A secondary learner need not follow the same path as the curator, nor reach the same conclusion. Instead they might choose to access the story in a different way and make different interpretations. This learner might even bring in additional knowledge and personal interests, backed up by further research to produce a completely new output of their own.

Framing historical inquiry as a curation task sets up a context in which the learner knows that interpreting, annotating and organising primary and secondary content is integral to their output. Through this process, the learner will be prompted to combine aspects of the historical inquiry process, with parts of SCIM-c approach to analysing and critiquing sources, and in the process will put themselves in a position where they can more easily follow the observed successful strategies of inquiry learners identified by Leat and Nichols (2000) in grouping and organising content to reflect their argument. In addition, by curating primary and secondary source material - a process through which the learner will choose which sources to include and which to omit from their final account - they create an output that, like an exhibition, might prompt future learners in undertaking their own inquiry. This notion of *recuration* of the content means that the student's output need not be filed away but could be part of future learning.

This idea is realised as a *curatorial inquiry learning cycle* for historical learning across web-based content. This cycle is shown in figure 4.1.

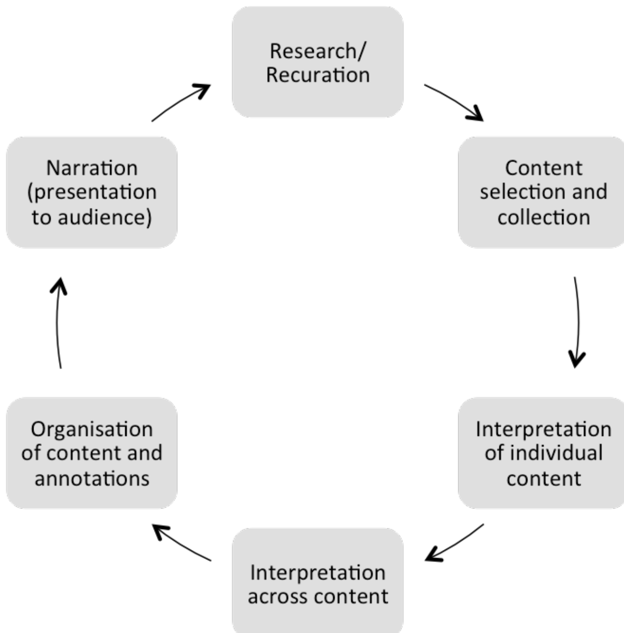

Figure 4.1. The proposed curatorial inquiry learning cycle.

The individual stages contain the following activities:

- Research – choose a learning goal and define the task boundaries.
- Content selection and collection – identifying and collecting potential primary and secondary source materials, making judgements on which resources are useful and which are not.
- Interpretation of individual content – annotate individual content to identify important facts and events.
- Interpretation across content – annotate from a task perspective, finding the important relations linking content and annotations.

- Organisation of content and annotations - organising (and re-organising) the annotations and content to develop a coherent story that answers the inquiry question. This involves identifying and organising sources (and their related annotations) that evidence important parts of the story and which should form part of the final narrative and using the annotations made when interpreting across content to link them together.
- Narration (presentation to an audience) – creating a presentation to an audience through a chosen medium that reflects how the content was organised in the previous stage.
- Research/recuration - the process through which the audience become participants in a narrative construction based on a previously curated output. Includes reflection (the author can recurate their own output to improve understanding).

While preliminary learning goal and question setting occurs during initial research, new questions or focus may emerge during the process of finding, interpreting and organising content. This in turn may prompt additional collection and re-interpretation. Also, although not explicitly shown in the figure, the learner may return at any point in the inquiry to an earlier point and re-continue the cycle from there.

4.2.1 CONTENT CURATION TOOLS

A number of tools exist for curating web content that could potentially be a readily available means to instantiate a curatorial inquiry learning cycle to support the curation of web content for historical inquiry.

Currently, there are multitudes of content curation tools available, many with different specialities. These fall under five basic categories. A few examples of tools available under each category are given. Whilst the examples are by no means exhaustive, they encompass a large range of features and cover a good range of what was currently available at the time of this analysis. This representative sample will therefore be used to assess curation tools to support learning through historical inquiry.

The categories and examples are:

- Storytelling: creating stories by linking web content, particularly social media such as Twitter
    - Storify[3]
- Collecting: collecting web content under thematic headings, often includes theme-linking
    - Bag the web[4], Pearltrees[5], Pinterest[6]

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[3] https://**storify**.com/
[4] www.**bagtheweb**.com/
[5] www.**pearltrees**.com/

- Learning: create learning tasks from web content
    - Learnist[7], Livebinders[8]
- Clipping: collect web-clippings, such as text portions and images from pages
    - Clipboard[9]
- Publishing: curate your own newspaper by selecting news stories from diverse sources around a common topic
    - Paper.li[10], Scoop.it[11]

The first key question is which curation processes are most essential to assist the learner in understanding and undertaking the inquiry task.

Liu (2010) makes the proposal that content curation tools should support the activities of a range of museum professionals, which are summarised below:

1. Archivist – find, collects and aggregates
2. Librarian – organises, classifies and categorises
3. Preservationist – cares for, preserves and maintains

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6 https://uk.pinterest.com/
7 learni.st/
8 www.livebinders.com/
9 no longer available
10 paper.li/
11 www.scoop.it/

4. Editor – selects, filters and verifies
5. Storyteller – weaves together, crafts a story to provide explanatory text or commentary
6. Exhibitor – displays, arranges and presents
7. Docent – teaches and guides, facilitates discussion, reflections and critiques

In the view taken within this thesis, it is the roles of archivist, librarian, editor, storyteller and exhibitor that are taken to be the key roles that are performed as part of actively curating a museum narrative, whether this is achieved by one individual curator or by a team of museum professionals. Therefore these comprise the components of the proposed curatorial inquiry cycle. The preservation of artefacts, and the teaching and guiding through a completed exhibition are taken as being separate to the curatorial process of exhibition creation.

Therefore, the following processes that comprise the curatorial inquiry cycle can be shown to support online content curation in the following ways:

Research - The research and initial task setting, either by the learner or a teacher, is important throughout all stages of the inquiry as it defines the boundaries of the task and is used for assessing progress.

Content selection and collection - Content collection involves deciding which content is relevant to a task and which is not. It should involve at least some assessment of the content – to ascertain relevance to the task, however deeper processing of source materials occurs only once the learner begins to interpret and annotate content.

Interpretation of individual content (content annotation) - Interpretation of content should occur in the context of the learning goal: like the museum examples mentioned previously, a piece of content can be subject to multiple different interpretations depending on the context it is being viewed in. Interpretation can be realized through content annotation. This is aimed at identifying the relevant parts of each unit of content and minimizing the distraction of information that is redundant to the task at hand. Incorrect annotations that include task-irrelevant details may need to be corrected as the learner gains more understanding throughout the task.

Interpretation across content (task annotation) - Content cannot be viewed in isolation, but must be considered against the other selected items. When interpreting across the resources to understand the relations between them, the learner might find it useful to make annotations that belong to a task, rather than to an individual unit of content. Interpretations about groups of content can be realized through task annotations. Annotation can be tagging, writing notes, or selecting the relevant part or parts of the resource. Since it is part of an on-going learning process, there must be the facility to easily change the annotations as new information comes to light. Creating annotations through interpretation has parallels with story building when viewed from a structuralist viewpoint (Chatman, 1978). The annotations can be thought of as events of the story, and the relations are the ‘emplotment’ (plotting of events) according to the author’s personal viewpoint. Based on the above, the proposal is that the quality of content annotations with respect to a given task will be better if the learner provides interpretations across content than if they annotate each item individually. The quality of annotations reflects the learners understanding.

Organisation of content and annotations - As the learner annotates and interprets content, a logical part of this process is the physical organisation of content and annotations to reflect the underlying story. This not only assists the learner in building a coherent understanding, but is also a vital step towards the next stage of presentation. Organisation can be part of interpretation. As identified by Leat and Nichols (2000) if the user can move content and annotations around and consider different items in proximity, or in different groupings, this might help the learner in interpreting across content.

Narration (presentation to an audience) - Whilst the organization in the previous step is aimed at helping the learner to understand and make clear the relationships in the story for their own purposes, the narration stage is aimed at communicating this understanding to other people. This is the narrative output of the story and underlying plot. Creating the narrative presentation might be as simple as pressing a ‘publish’ or ‘share’ button, making all of the task materials publically available, or the learner might use other output mediums, such as essays or posters. During narration, the learner may reflect on their output and the extent to which they have addressed the task.

Some principles of narration could potentially affect future learners. For example, if the goal is to produce an output from which others can easily learn, then a web-based publication that links to source materials is better than a physical presentation such as a poster - unless it is also backed up by access to all of the source materials.

Through exploring these links between curation and historical inquiry it is possible to identify a set of functionalities that a curation tool should support in order to also support a historical inquiry process. With this in mind, the social curation tools mentioned in the beginning of section 3 will be analysed according to the extent to which they support the following features:

F1: Content selection and collection - collect content under a task heading (also considering the source of content, e.g. You Tube, Twitter)

F2: Interpretation of individual content: annotate content (tagging, note making, clipping)

F3: Interpretation across content: make task annotations, i.e. annotations that apply to sub-groups of content

F4: Editing of existing annotations: revisiting and refining is an important part of the process

F5: Organisation of content and annotations: facility to organise both content and annotations

F6: Narration - presentation of output in a way that facilitates recuration

It should be noted that the research phase is not in the above list, as this is not an activity supported by tools. Also, there is an additional activity specified in the ability to edit existing annotations. This is included as not all tools support corrections and editing, yet as mentioned before it is important within an inquiry to be able to revisit steps and to make changes to thinking. The results can be seen in Table 4.1. As can be seen from this table, most sites support some kind of content annotation, although the extent to which notes were easily viewable alongside content, or could be edited, varied a great deal. Storify was the only tool that provided good functionality for providing interpretation across content through task-related annotations that weren't tied to a particular piece of content. This goes some way to mitigating the key issue with Storify, which is that individual content annotation wasn't very flexible. Very few sites allow the collected content to be flexibly organised by the user. This is particularly surprising when looking at the sites specifically targeted towards learners. Pearltrees is the only site to allow a non-linear organisation of the content. All sites promote the re-use of their content making it easy to take items that have been selected by another user and add them to the user's own topic.

Tool focus	**Tool**	**F1[12]: collect**	**F2: interpret (individual)**	**F4: interpret (across)**	**F3: editing annotations**	**F5: organise**	**F6: narrate/ recurate**
Story-telling	**Storify**	W, SM	Notes – but only viewable in some contexts	Yes – can add text nodes	Yes – task No - content	Yes	Yes
collect	**Bag the web**	W	Notes	No	Yes	Yes	Yes

[12] W – Web content
SM = Social Media (Facebook, Twitter, Youtube, Flickr)
O = Own content
I = Images

	Pearltre	W	Notes – can also see notes from other users	No	Yes – own only	Yes – non linear	Yes
	Pinterest	I	Notes	No	Yes	No	Yes
learn	**Learnist**	W, O	Notes	No	Yes	No	Yes
	Livebinders	W, SM, O	Notes, tagging	No	Yes	No	Yes
clip	**Clipboar**	W	Notes, clips	No	Yes	No	Yes
publish	**Paper.li**	W, SM	No	No	N/A	No	Yes
	Scoop.it	W, SM	Notes, tags	No	Yes	No	Yes

Table 4.1. An analysis of social curation tools.

4.3 QrAte tool

The QrAte tool (Questions, resources, Answers, tagging and evaluation) was developed to address some of the shortcomings of the surveyed web content curation tools. A set of wireframe mock-ups were created as part of the early design process, for mapping the curatorial inquiry model to specific functions afforded by the QrAte tool. The QrAte tool was built from this set of design documents. A storyboard of mock-ups and description of their mapping to the curatorial inquiry model can be found in Appendix A. QrAte was based on the Storyscope (Mulholland et al., 2013) platform for supporting museum curators to create stories about their objects and to create larger narratives across collections of museum content. Storyscope was written in Drupal 6 and used a MySQL database for storing content. The core functionality was provided through custom contributed modules. The aim of QrAte is to support all phases of the curatorial inquiry learning cycle. As identified in the previous section the supported activities are:

- Research
- Content selection and collection
- Interpretation of individual content
- Interpretation across content
- Organisation of content and resources
- Narration
- Research/recuration

The QrAte approach is aimed at producing an output that communicates the learner's own understanding of the task through a coherent response to the inquiry question, whilst also providing a curated 'reference list' of sources that can feed into a new learner's inquiry. The goal of the new learner's inquiry is to recurate these objects into a new presentation, during which process they may discover logical inconsistencies and other possible interpretations to be reflected in their own outputs.

Some of the functions of QrAte are those found in standard social curation tools. Where QrAte differs is in the support provided for data gathering and interpretation. The stages of a QrAte inquiry can be aligned with the GATHER model (Table 4.2).

	GATHER	QrAte
G/A	Get an overview. Understand the general	Research - choose a learning goal and define the

	topic and the historical context.	task boundaries.
	Ask a probing question. Ask a question that will require an investigation involving analysis of several sources.	
T	Triangulate the data. Triangulate data from different types of sources (primary, secondary and expert opinion)	Content Selection and collection
T	Triangulate the data. Triangulate data from different types of sources (primary, secondary and expert opinion)	Interpretation of individual content
H	Hypothesise a tentative answer. A working hypothesis should provide the basis for further investigation (e.g. to find facts to support a proposed hypothesis)	Interpretation across content
E	Explore and interpret the data. Look for the data to support the hypothesis. If the data does support it, then move to stage 6 (record and support conclusions) otherwise revise the hypothesis and repeat.	Organisation of content and annotations
R	Record and support your conclusions. Create a historical narrative and argument demonstrating the conclusions that have been reached.	Narration (presentation to audience)

Table 4.2. Aligning GATHER stages with the QrAte curatorial inquiry cycle.

Each stage is reflected in the interface to provide a clear route through the inquiry (figure 4.2). The relationships between the menu items shown in figure 4.2 and the stages of curatorial inquiry will be discussed later. Firstly, the different activities within QrAte are discussed in detail, using examples from an inquiry: '*Did the activity of code breakers in Bletchley Park during WW2 have any impact in shortening the war?* '

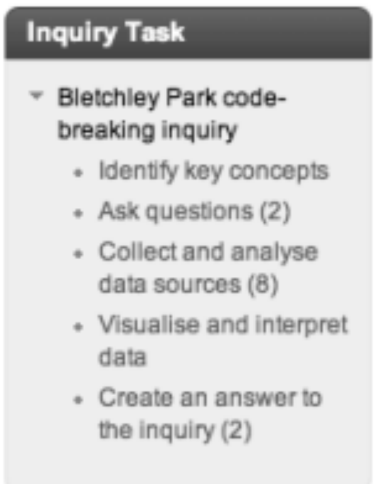

Figure 4.2. Left-hand pane of a QrAte inquiry task (framing problem for Research phase).

A. Identify key concepts

Key concepts are entities that are central to the current curation task and background inquiry. Examples from the Bletchley Park inquiry are *Alan Turing, Hut 6, code breaking, 1942, and Enigma Machine*. They are used for annotating learner's notes during data analysis, which in turn is used for grouping and organising notes in the visualization stage. Consistent with the 'overview' phase of GATHER, they might also be used as search terms to find additional content, and to support question making. Key concepts can be placed into categories. QrAte is pre-supplied with categories relating to a standard event description: people, places, objects, time, and actions. These descriptions were found by looking at the popular event ontologies of LODE (Linking Open Descriptions of Events) and CIDOC-CRM. Event ontologies provide standard schema through which events can be represented, which can facilitate both human and machine interpretations of events. The purpose of using these categories is to prompt learners to break down narrative sources to the event level, making it easier to re-emplot them into their own stories. They further prompt the learner to think about the setting (time and place) and theme of the developing narrative, for example if a number of sources (or events derived from sources) emerge from a similar time period they can then be placed into chronological order.

Key concepts can also relate to processes of the inquiry as identified by Leat and Nichols (2000), e.g. background fact or trigger factor (an important causal factor), or 'house-keeping' tasks, e.g. '*section 1*'. Key concepts should in the first instance be taken from the background information, the inquiry topic and any sub-questions. New concepts will become apparent as information is uncovered throughout the inquiry.

B. Ask questions

The learner is prompted to ask inquiry questions, which can be reordered during the inquiry process. Learners may need help in asking effective questions. Walton and Archer (2004) have demonstrated that providing a simple checklist of 'good' questions can effectively help the learner devise appropriate questions for evaluating resources.

QrAte provides a standard checklist to assist students in this stage, but tailor made help can replace these if desired. Example questions from the Bletchley Park example include: '*What examples can you find of intelligence being used to inform wartime activities?* '

C. Collect and Analyse Data Sources

As previously discussed, it is important to include both primary and secondary sources in an inquiry. The data sources in QrAte are conceptualized as heritage objects (much as you would find in an art gallery or museum) plus the background information relating to them. In addition to pre-supplied sources, students are encouraged to locate content for themselves using *key concepts* as possible search terms. Data sources can be uploaded as files or web pages which contain text, images or movies, and which can be added to the inquiry through a bookmarking tool. Most kinds of documents can be included, such as worksheets provided by a teacher to be completed and then re-uploaded (for example, worksheets provided with the HSI tool). Each source is then analysed. Analysis involves making notes and assigning key concepts to these notes. Each note should represent an important fact or event, relevant to the inquiry. Once a note is made, it can be assigned to one or more relevant questions (figure 4.3).

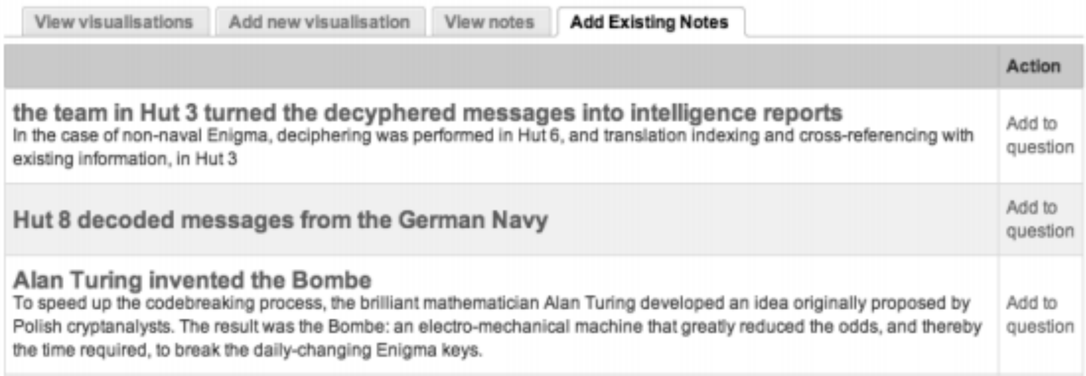

Figure 4.3. Adding notes about a datasource to a question (interpretation of individual content).

D. Visualise and Interpret Data

Notes that have been annotated with time information can be visualized on timelines (produced through simile/exhibit - http://simile-widgets.org/exhibit/), where they are colour-coded and filtered by key concepts (figure 4.4). List views allow notes to be put into groups and reordered within those groups. This functionality reflects the strategies that students naturally use when conducting an inquiry. This is where the facility to create a category of ‘factor type’ and to tag notes as being either background facts or trigger factors provides particular benefits to the learner. Visualisations are created for each question. Students must reflect on whether they have enough information to answer the question and if not, to try to continue in the inquiry. Students must assess whether or not they think their proposed answers are supported by the evidence.

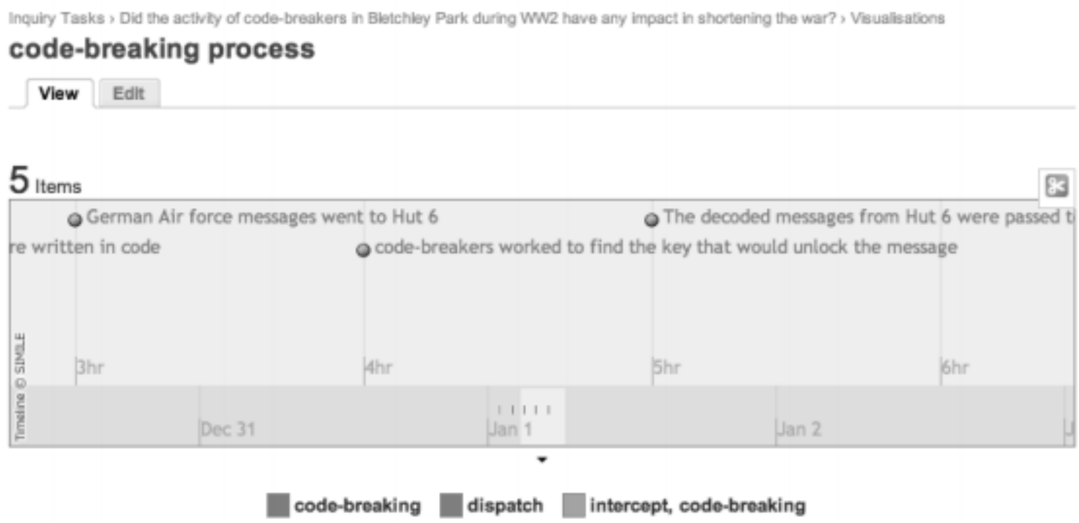

Figure 4.4. Example visualisation on a timeline (interpretation across content).

E. Create an Answer to the Inquiry

Students write answers based on their conclusions from the data interpretation. Initially data sources are output in a 'suggested order' based on how their related notes are organized and annotated. Thereafter, the student can exercise curatorial choice in the final narrative, by choosing which sources to include and the extent to which the background story is made explicit. Sources can be dragged to re-order and explanatory text or other media can be added in between (figure 4.5). The student might pull in their notes to act as 'explanatory glue' between visual elements, or include worksheets and timelines to explain the presentation. When the student is happy, they publish their presentation. For the teacher, the final inquiry output consists of: the full set of inquiry questions and answers; the key concepts; the data sources and worksheets; the set of notes (including their annotation by key concepts and organization); a curated set of content. Notes link back to their sources, so the teacher can see where statements have come from and trace back errors or misunderstandings. If a student has made a supposition, due to missing data, the teacher can easily see that the note has no data source attached to it. This phase is equivalent to the process of museum curation in which the curator writes explanatory panels for individual objects and then writes the main 'wall panel' that signposts to the visitor how pieces within a particular physical space are related, e.g. through a shared setting or theme.

Figure 4.5. Example of story curation interface (organisation of content and annotations).

Finally, it is worth revisiting the relationship between the activities of QrAte summarised in figure 4.2 and the stages of the proposed curatorial inquiry model. Firstly, the *identify key concepts* and *ask questions* activities support the **research phase** of a curatorial inquiry, in which the problem is framed. *Identifying key concepts* can also support aspects of **content selection** by providing possible search terms. Secondly, *collect and analyse data sources* supports a number of stages of the inquiry, including the **collection of content** related to the inquiry, and an exploratory **interpretation of individual content** including the ability to offer multiple different interpretations. *Visualise and interpret data* allows some **interpretation across the content** that reveals mostly temporal/thematic relationships between them. Finally, *create an answer to the inquiry* brings together many aspects of the curatorial inquiry process. In this stage, objects and interpretations are brought together into one place to allow **organisation of content.** It is also possible to **create interpretations of individual content** as well as propose ideas that provide context across several items (i.e. **interpretation across content**). The outputs created here can also support further **research and recuration**. Finally, the **narration** stage of the curatorial inquiry occurs from the output of this QrAte stage.

4.3.1 PROPOSED BENEFITS OF THE QRATE HISTORICAL INQUIRY TOOL

QrAte is intended to provide an easy, flexible authoring environment for creating historical inquiry tasks from mixed resource types and to support the learner in transformative and regulatory inquiry processes. It is designed to be generalisable and adaptable to many different tasks, rather than just for one specific inquiry. QrAte allows flexibility at each stage for authoring towards:

1. A specific task. Help prompts, instructions, source materials, questions and introductory texts can be uploaded for each task and then shared amongst learners.
2. A specific audience. Each QrAte stage can be more or less pre-structured by a teacher. At one end of the scale, it is possible for a user to conduct their own inquiry from scratch, whilst still being guided through the essential inquiry processes. At the other end of the scale, the inquiry can be pre-completed by the teacher and given to students to assess all of the information and curate their answer.
3. A preferred approach. Documents can be uploaded to assist with source analysis, e.g. using SCIM-C. A WebQuest or HSI task can easily be realized through QrAte, with the added benefit of capturing the students' data.

In undertaking an inquiry using QrAte, the learner will assess a number of source documents, some of which will be revealed in the final narrative and some that will be left as reference materials. The goal for the learner is to have created an argument that is backed up by the evidence they have found, rather than an answer that is objectively 'correct'. The following explores a user scenario of QrAte.

Cally is a history teacher who wants to use QrAte to get her students to explore the history of code breaking in Bletchley Park. She would like students to answer the question 'Did the code breaking activities have any effect on the outcome of World War

II?’ Cally collects a set of resources for the inquiry. These include: pictures; first hand accounts of people who worked at Bletchley Park; video footage from the period; several essays by other historians explaining the role of Bletchley Park in providing key intelligence as well as general background to the war; photographs of important objects such as the enigma machine, with links to pages explaining how these objects work. Sophie and Zane are two students working on the inquiry. They both begin by reading all of the resources provided by the teacher and thinking about how they can be used to answer the question.

Sophie starts by pulling in all of the available resources. She carefully reads each one and makes a note against it of the information she thinks is relevant to answering the question. She makes three separate notes for one of the essays, one relating to an image in the document that shows the invasion of Poland in 1939, one giving the date of VE day for referencing the end of the war and the final one that explains how the cracking of the Enigma allowed British intelligence to know much more than they otherwise would about planned German attacks. Sophie completes her assignment by organising these notes in temporal order, from the start to the end of the war, using photographs of the Enigma machine and testimonies from people who worked at Bletchley Park to give extra context to her argument. She bases her argument around the premise of one of the essays, explaining that the superior intelligence allowed British troops to focus their efforts where they would have most impact. As she organises the notes (and associated resources) she adds additional text to explain her line of reasoning and to develop the narrative further. The teacher has asked for an essay as output, so when she has finished organising content within QrAte and making notes, she writes the essay and uploads it. Everything is submitted, including all the notes she has made on resources she did not use in the end.

After reading all of the resources, Zane starts to write a different sort of narrative. He wants to structure an argument along the lines that extra Enigma intelligence may have speeded up the end of the war, however without it the outcome would be the same but with greater loss of lives. Zane pulls in just a few resources that he will use to answer the question. He makes notes on these and then searches for additional resources online to support his argument. He bases his arguments on different types of intelligence used during World War II and earlier Wars. Zane also organises all of his notes associated with resources, but he can't decide which way is best to organise his narrative. He makes two versions, one in which he talks about intelligence used in wars in general and then moves onto arguing that Enigma intelligence was just one kind available during World War II. In the second, he starts by discussing the role of Enigma in the outcome of the war, according to the original sources. To do this, he must revisit the initial teacher set and pull in some more reference materials. He then brings in his own additional resources at the end to provide an 'alternative ending'. He writes his final essay based on this second version.

Cally is marking assignments. As resources are attached to the organised notes that the essays are written from, she can see the source of evidence the students are using to support their arguments. She sees that Sophie has taken a lot of information from a single source. She also sees that Zane has taken a lot of resources from the Internet that were not part of the set she originally provided and that he made two attempts at organising resources. She also feels that the first organisation was leading to a stronger argument. She gives her mark based on the submitted essay, but in the feedback she references the first, stronger, piece of work.

This scenario shows how undertaking historical inquiry may draw on principles of museum curation. In this way, it is the process of developing the narrative and organising the resources that helps the author in making sense of the available evidence and choosing which perspective to take. Through the above scenario it is also possible to see how a teacher or learner looking at the output of another learner's inquiry in QrAte will be able to see what sources they have used as references, even where they have not been explicitly used in the final narrative. These will still appear in the resources list, along with any annotations made by the learner. Using QrAte it may be easier to differentiate between notes that reflect more objective facts and events identified from sources and notes that reflect the student's own thinking. In this way, something like the QrAte tool could provide support for the types of narrative inquiry where the goal is to produce a coherent argument backed by evidence but where the output may be somewhat subjective.

4.4 Conclusions

The first sub question of this thesis (SQ1) asked the question '*How can methods from inquiry and from the curatorial practices of museums inform narrative construction?*'

In answering this question, this chapter reveals that it is possible to demonstrate clear links between the process of historical inquiry and the different stages of curating an exhibition. In both cases, a narrative argument is constructed to answer a question, through the analysis of primary and secondary source materials. Sources for an inquiry can take many forms. Examples include art objects, museum pieces and physical documents as well as digitised versions or representations of the same. Whereas curators often work in the physical realm, student historians often work online using digital surrogates of primary materials as well as additional web resources. Both the curator and the student historian may be required to create narratives across diverse types of objects in different media, for example combining museum objects or artworks with video or audio exhibits and written documents or photographs. The goal of the historical inquiry in the classroom has typically been some form of essay. The aim of this work was to try to demonstrate how framing the inquiry as curation might benefit a learner to overcome some of the difficulties faced during an inquiry process, such as learning how to identify important facts and historical events that form part of larger narratives and to disregard those that are not relevant to a question, as well as being facilitated to think how they can organise and reorganise their annotations and historical sources to structure them into a coherent narrative presentation. This approach is supported by the observed strategies of students undertaking inquiries, as identified by Leat and Nichols (2000).

Social media tools at the time of analysis did not fully support all stages of the curatorial inquiry process. Therefore, the QrAte tool was developed which not only supported the main phases of the cycle but also facilitated the learner in tagging content according to event properties, which in turn could potentially assist in organising content by narrative principles of *setting* and *theme*. Timeline views of time-annotated content could provide additional support. The tool was designed to make it easier to identify similarities and differences across students' thinking about the same inquiry question from the same set of sources, by identifying which sources had been used or omitted in the final narrative organisation and what facts or subjective interpretations were associated with them.

This tool was not evaluated with users and so it is not possible to present empirical evidence as to the usefulness of this approach. However, in as much as it extends functionalities present in the majority of content curation tools and that these extensions are based on a detailed analysis of both historical inquiry processes and museum curation, it is reasonable to suggest that both the curatorial inquiry approach and the QrAte tool design itself offer some support for working across multiple types of web content.

The model of curatorial inquiry does, however, provide a basis for understanding how sense can be made from discrete objects of potentially differing forms when they can be moved around, either in an online space, or by a curator organizing objects onto walls and into museum spaces. With respect to the overarching research question (MQ1), 'How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?' it identifies a conceptual narrative that tells of the relationship between objects, either in the online or physical world.

The remainder of the thesis explores how narrative coherence might be found within a physical space when it is not possible to move objects to reflect the narrative, and how the model of curatorial inquiry may offer some insight into how to support this.

5 IMMA SCULPTURE GARDEN

Visitors to museums are not only interested in discovering all about individual objects, but also to understand the wider context of an exhibit, in terms of historical background and how it is related to other items on display. As previously discussed, when a museum professional constructs an exhibition they commonly aim, as much as possible, to group and organise items so that these stories and thematic relationships can be easily highlighted to visitors (Peponis 2003a).

Outdoor artworks are a popular addition to the grounds of many museums, and indeed many other public spaces such as towns, parks, and public gardens. Often they are not selected as part of a single exhibition, but are acquired over a period of time and placed with reference to the physical rather than a conceptual context. Despite this, relationships often do exist between outdoor artworks, based on artists, materials, art period, theme of a piece, historical events. These stories can be hard to reveal, because the artworks cannot be moved to reflect narrative connections, and because information provided for artworks in outdoor spaces is often quite minimal.

The previous section proposed a curatorial inquiry cycle to support learners in constructing narratives across web-based content. The approach is based on the idea that there are similarities in conducting a historical inquiry across web resources and in the processes of museum curation. The proposed benefit for the learner in following the curation approach is that they are prompted and facilitated in annotating and organising the primary (and sometimes secondary) sources to reflect the emerging coherent narrative argument that is constructed to answer the inquiry question. In essence, they act like museum curators, moving content around and this process helps them to structure a coherent narrative across the set of resources.

The question explored now is how to support learners in constructing narratives across a set of objects in a physical space, where objects cannot be physically moved to reflect temporal, spatial or thematic narrative relationships, and where the visitor is likely to encounter many different intermingled narratives.

Mobile technology offers the possibility to address this need. Mobile applications can make information about an artwork available on a user's own device and also show the conceptual links that are not reflected in a physical layout. This was summed up by a 2010 Horizon report on museums (Johnson and Witchey, 2011), which said that:

"Museums are poised to use mobiles to create and deliver educational and interpretive experiences, supplying contextual information to engage the visitor and allow them to make connections between objects and ideas, people, places, and institutions."

As discussed previously, the common approach to developing mobile applications is in creating technology that directs a visitor towards the next point of interaction based on some identified interests, thus leading them on some sort of connected trail across a set of objects, either in a museum, or outdoor space or city. Whilst these experiences are undoubtedly interesting, not every visitor wants to travel on a fixed route and some visitors prefer to choose their own paths. Visitors do not necessarily demonstrate that they are willing to change their route to visit interesting objects, either in the small space of a museum (Sharples et al., 2013) or the larger space of the city (Mitchell and Chuah, 2013).

The question then is how to create an application that provides a coherent narrative experience across a set of objects in a physical space, yet allows visitors to freely explore and choose what to stop and engage with, without explicitly suggesting where they need to go next. In this scenario, the visitor should be facilitated to follow a convenient physical pathway between cultural objects or places whilst also being supported in understanding how the places that they visit are, or are not, connected to one another.

A possible approach to supporting visitors in this scenario is now discussed in the context of visitors exploring artworks in the grounds of a museum. The place in question where the approach has been tested is the Irish Museum of Modern Art (IMMA), in Dublin. This work was conducted as part of the Decipher project in which the Storyscope system (introduced in Chapter 4) was created for supporting curation of museum exhibitions. In order to provide context for the following discussion, some of the functions of Storyscope that were used to support this work are now described.

5.1 Storyscope narratives and microsites

Storyscope is a web environment for authoring stories that reveal relationships between museum objects. Using Storyscope, an author can write stories about museum objects, whilst recommender components use narrative principles to suggest ways to extend the story and to find new objects for inclusion within the narrative.

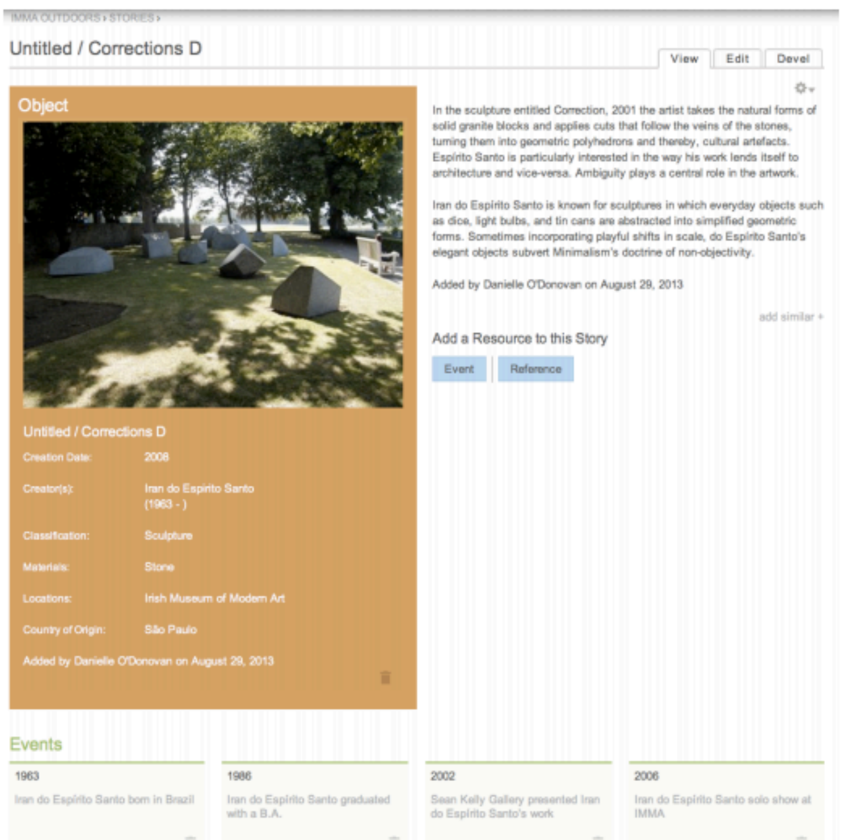

Figure 5.1. Example of an object story in Storyscope.

This is made possible through the representation of stories in terms of their important events describing the people, setting (time and location) and themes (historical period, genre, materials, activities), some of which can be derived from the object metadata. Figure 5.1 shows an example of an object story, with object metadata and some story events. An object story is equivalent to a panel of text that appears alongside an object. Story content can be extended using the narrative principles of setting and theme, as identified by Wolff et al. (2013), which can be used to find *new events* related to existing events contained within the story being told. This in turn can be used to identify and bring in related objects (e.g. objects by the same artist, or from the same period) to which a new event is attached.

5.1.1 THE NARRATIVE RECOMMENDER

A Storyscope narrative consists of a number of distinct story sections, each of which is roughly equivalent to the separate rooms of a museum into which objects are thematically grouped. Within the individual story section are the objects and stories related to this theme.

Storyscope has a narrative recommender, which uses the object metadata and story event properties to propose how to organize story sections into coherent trails, designed to lead the visitor from one section to the next in a coherent way, for example leading the visitor through time periods or different stages of an artist's career.

Shahaf et al. (2012, 2013) propose a method for structuring documents into coherent trails using a metro map metaphor, which represents intermingled storylines as different coloured metro lines. Storylines are created from documents using notions of coherence, coverage and connectivity of concepts related to the content. Coherence calculates a similarity measure between documents, using a procedure that is suitable to the domain. Coherence is calculated with respect not just to potential neighbouring documents but to a set of documents that could form the coherent whole. In this way it is a global measure across a set of documents, and doesn't provide only local coherence. Coherence is used in conjunction with coverage, which ensures that a storyline both covers a set of topics of interest but also contains diversity (the topic is not overly repeated to provide redundant information). Finally, connectivity shows where different storylines have a point of interaction with each other - in the metro metaphor, this is represented as a station interchange.

Similarly, the Storyscope narrative recommender uses notions of coherence across sections and also coverage of available story events and objects that would be included in the proposed trail. Coherence is measured by the cosine similarity between a group of property vectors. Property vectors are obtained from both event properties and object metadata of the object stories associated with a story section. Coverage of events or objects is measured with respect to the total number of each available to the story, i.e. all objects and events that have been put into the dossier of the narrative as potential building blocks for the story. A trail is produced by hill climbing (Russell and Norvig,

1995) from a number of randomly selected start points. In each step, the result of merging story sections that are not already in a trail is evaluated in terms of what this merging contributes towards increasing a score, which is weighted according to how important coherence, event and object coverage are for that particular narrative output. The best section is always chosen. When there are no sections that can be chosen that increase the score, the path is returned. A trail developed in this way has a natural order. Considering a situation where coherence is considered to be most important, then from the starting point the next section chosen must be the most coherent with respect to that starting point. In the next step, the section chosen is the one that is most coherent with respect to the entire path up to that point. Therefore, in each step the overall coherence of the trail is considered and not just the local coherence to the previous step. The narrative recommender was developed through several iterations, which included evaluation by museum professionals and improvements in response to feedback received. Evaluation revealed a clear preference for highly coherent outputs over inclusion of more objects or events. This means that often the trails produced are quite short, but densely connected.

Storyscope supports the publishing of narratives as navigable microsites (see figure 5.2), which are essentially a web equivalent to all, or part of, a physical exhibition, museum catalogue, handout or tour. In the microsite, the order of visiting story sections is suggested by the ordering of the hyperlinks.

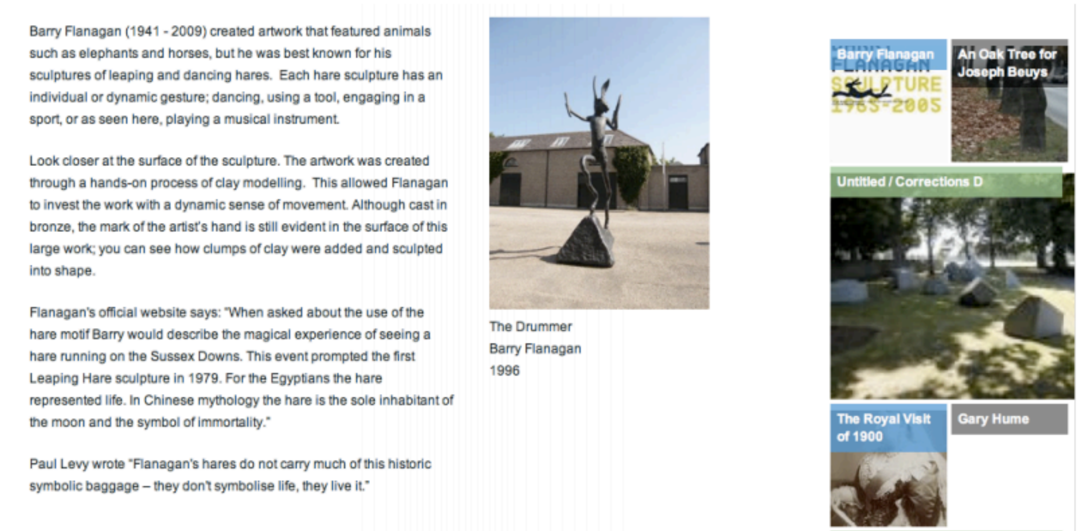

Figure 5.2. A microsite produced from Storyscope.

As part of the Storyscope evaluation, IMMA were interested in applying the narrative recommender to the task of discovering conceptually interesting visitor journeys through 27 artworks in the ground of the museum and in using Storyscope to publish a microsite for access via a mobile device, which would be accessed by scanning a QR code placed next to each artwork in the grounds.

In this sculpture garden there are a number of artworks, some of which are related to each other and some of which aren't. Therefore, the normal way in which the narrative recommender was intended to be used – to create a coherent exhibition across a selection of closely related content – did not apply in this case. The goal was to develop an approach in which the narrative recommender and the stories produced from it could still create an interesting visitor experience but one in which visitors were not explicitly directed in terms of what items they should or should not engage with, or where they should go next.

5.2 Physical And Conceptual Neighbourhoods And Trails

To begin, a model is proposed in which objects can be described as being simultaneously situated within both a *physical* and a *conceptual* neighbourhood, containing other objects and places. This model is illustrated in Figure 5.3. In this example, a person is standing near a statue of a lion. In the *immediate* physical neighbourhood of this statue, they can walk around and view it from multiple perspectives or they can traverse the *extended* physical neighbourhood by following a *coherent path* that takes them each time to the next physically closest object that they haven't seen before.

The conceptual space is represented as a story. The first story is the one about the object the person is standing close to in the physical space. This story, in the *immediate* conceptual neighbourhood of the lion, tells of the artist, the material and the year in which it was made. The *extended* conceptual neighbourhood tells of a relationship to other art objects, both within the same physical neighbourhood as the lion and outside it. The ordering of objects in conceptual space is different to that of the physical environment, too. The transitions between objects are based, in this case, on the conceptual proximity. These ideas are now discussed in more detail.

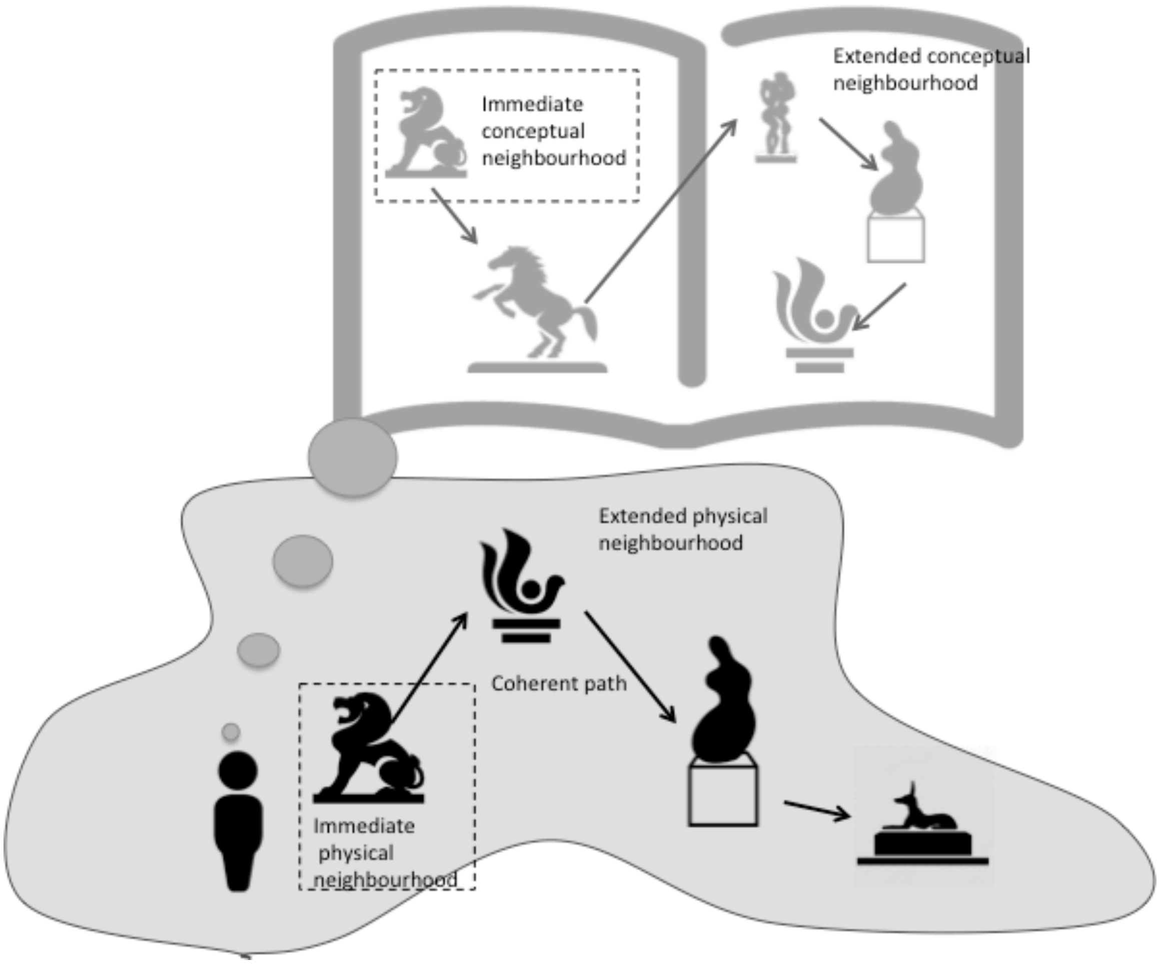

Figure 5.3. The immediate and extended neighbourhood of an object in physical and conceptual space, with coherent paths picked out between them.

5.2.1 PHYSICAL NEIGHBOURHOOD

The *physical neighbourhood* is the real-world setting of the object. A visitor can experience the object in the real-world setting and then travel through the physical space to find new objects to engage with. In the *immediate physical neighbourhood*, a visitor is able to walk around and view an artwork from different perspectives. Within the *extended physical neighbourhood* the visitor can navigate between objects that share the same physical space. As the visitor navigates through this physical space, the topography of the environment they are travelling through has an influence on the path chosen by visitors. Through analysis of visitor movement in different museum settings Stravroulaki and Peponis (2003) identified that navigation commonly takes place using physical proximity and line of sight. In other words, people are more likely to travel to things that are nearby and that they can easily see. An example of this can be seen in figure 5.4, where the path on the right hand side appears to afford a path between the artwork in the foreground and the one in the distance.

Figure 5.4. Showing the extended physical neighbourhood around an outdoor artwork.

In this way, a trail between artworks may be afforded by the layout of the space. For example in the grounds of the Irish Museum of Modern Art (IMMA) a number of artworks are found along a driveway from one of the entrances. It seems likely that visitors would prefer to travel between these artworks in a particular order, following a coherent trail between artworks, in which they do not have to double back and re-pass artworks they have seen before.

5.2.2 CONCEPTUAL NEIGHBOURHOOD

The *conceptual neighbourhood* of an object describes related associated concepts, such as important themes, people, times and places associated with it. Narrative provides a means by which visitors can understand and navigate the conceptual relationships between objects in a conceptual space. As previously discussed, narratives – particularly something like a museum narrative – will organise content coherently such that conceptually similar items are close to each other and so that the overall narrative has commonalities of setting and/or theme. Therefore, objects in a conceptual space are navigated through conceptual proximity, in which closely related items share similar properties.

In the *immediate conceptual neighbourhood* of an artwork, a visitor may come to understand something about the person who created it, what the artwork is about, when, where, how and from which materials it was created and maybe where it has been exhibited before. This information is commonly conveyed by a combination of metadata and stories associated with the object, which could be in any medium, for example text panel, audio guide, video, mobile information, augmented reality tool, or paper-based hand-out. The *extended conceptual neighbourhood* of the artwork may also contain additional artworks that share some of the same conceptual space, for example they are made by the same artist, of the same material, have the same theme, or are linked through shared events in history. In much the same way that a visitor can follow a coherent physical trail between artworks, they can also follow a coherent conceptual trail that informs how the artworks are related to each other.

This information might be conveyed in a number of ways: through stories that explain relationships in a linear fashion using text, audio or video presentation; through themed trail maps, that show a selection of artworks according to some common principles and where they exist on a map; on web pages, which show semantically related content through hypertext links, such as is found on Wikipedia, or as has been used in the Storyscope microsites described above.

Figure 5.5 shows the conceptual neighbourhoods of the two pieces shown in figure 5.4. This is an excerpt from a sculpture trail catalogue that describes outdoor artwork in the grounds of the Open University, U.K. In this case, it can be seen that the two pieces share both a close physical and a close conceptual neighbourhood, since the two artworks are both sculptures, by the same artist, and from the same material.

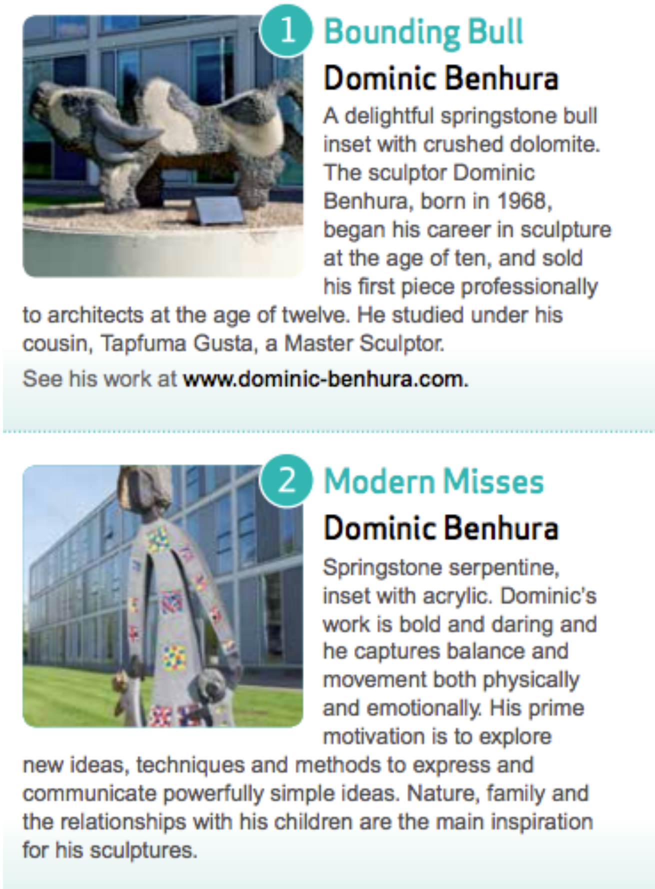

Figure 5.5. A conceptual neighbourhood of two related artworks.

5.2.3 NEIGHBOURHOOD BOUNDARIES

Each neighbourhood should have a boundary, which identifies the full set of navigable objects within a particular context. The boundary of either a physical or conceptual neighbourhood might be decided by 'ownership', or where a gap becomes too large between one item and the next. For example, in the physical space the objects outside the grounds of a museum, or a long distance to walk might fall outside the physical boundary. In the conceptual space, objects that contain no conceptual overlap with any other objects in the same neighbourhood would fall outside the conceptual boundary.

From this definition, it is clear that there may be full, partial, or no overlap between the physical and conceptual neighbourhoods, depending on the viewpoint from which objects are viewed and how conceptual narrative proximity is calculated. For example, in the loosest sense, there is a narrative connection between all objects that can be easily physically navigated in that they share a similar location and are all being navigated by a person at a particular moment in time. However, the assumption is that the more interesting narratives will be based on more complex conceptual links than these, and at least partial overlap of some objects in both the physical and conceptual space along further dimensions related to, for example, historical period, people, materials etc. At the other end of the scale, a carefully constructed museum narrative might reflect the case in which there is complete overlap – all objects have been chosen due to some overall coherent theme.

5.2.4 PHYSICAL AND CONCEPTUAL TRAILS AND THEIR ALIGNMENT

In addition to considering the amount of overlap of objects within the boundaries of the physical and conceptual neighbourhoods, there is also the possibility that a conceptual neighbourhood will contain links to objects (via story connections) that are not in the same physical neighbourhood as the visitor.

For example, in the sculpture garden there may be one object that has no link to any other object that is found in the grounds, however, story links could be made to off-site objects by the same artist, and this could form the basis of an interesting narrative constructed around that one object.

In the first case, where a conceptual trail links objects that are also found within a physical neighbourhood, the visitor has the opportunity to directly experience the objects within a narrow time-frame. In the second case, a visitor might read stories relating to objects that are elsewhere in the world (or perhaps do not exist any more).

In the scenario of the museum sculpture garden, there is only partial overlap between objects within the physical and conceptual boundaries. For outdoor artworks, which cannot be moved to reflect a conceptual trail, there will also likely be a mismatch between a coherent physical path that a visitor might take and the conceptual path that tells a coherent story across some, or all, of the artworks (Figure 5.6). This is the case with the outdoor artworks at IMMA.

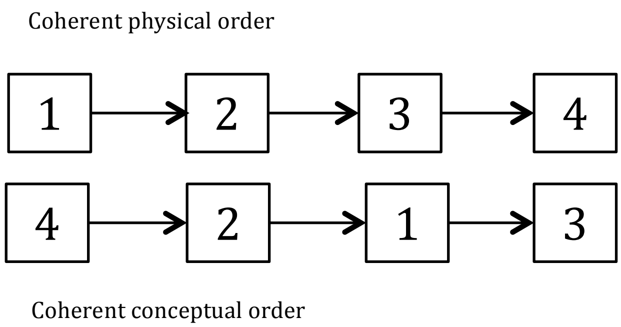

Figure 5.6. Showing unaligned ordering of objects along physical and conceptual paths.

One possibility is therefore to make a story trail from *each* object in the physical space, which organises stories - about both objects within the physical space and without it - into a conceptually coherent order. This allows that it is possible to visit objects in any order within the physical neighbourhood and at each point to experience a coherent conceptual experience. In this case, some of the objects may have been already encountered, some may be encountered in the future within the same visit (or could be 'missed' by the visitor) whilst those that are outside of the physical neighbourhood will not be visited at all at that time. The aim is to ensure local coherence for any given object. This approach is supported by the findings of Tzortzi (2011) who identified that visitor behaviour in the museum was display led. Through analysis of objects, layout and visitor movements in four museums - the National Museum of Modern Art in the Pompidou Centre, Paris, Tate Modern, London, the National Archaeological Museum and the new Acropolis Museum in Athens -Tzortzi identified that visitors would act differently in different parts of museum depending on interest, for example stopping longer in one time period and passing quickly through others. This was the case even if the layout made some places more difficult to reach or if an exhibition had some level of interruption (i.e moving between two regions of the museum to see all of the exhibits). Therefore, Tzortzi suggests to provide in the museum locally coherent regions and to afford movement around these spaces as a priority over providing routes between them.

5.3 Experiment Design

The above model was used to develop an approach to support visitors to the IMMA sculpture garden. The study was partly designed to answer questions of the museum professionals. Therefore, one goal was to evaluate the output of the Storyscope narrative recommender in terms of the usefulness of the conceptual trails discovered amongst only minimally related artworks (compared to more formally constructed exhibition content). Another goal was to discover how willing visitors were to use mobile technology at the same time as engaging with the outdoor artworks. In terms of the research questions, this study was designed to provide insight into how the construction of narratives can be supported in a physical space when objects cannot be organized to reflect the underlying narrative. To this end, design of the experiment provided a task context for thinking about how to facilitate visitors in navigating both physical and conceptual space (as described in the previous section) and the opportunity to evaluate the model by analysing how visitors engaged with the technology.

QR codes were selected to mediate interaction for two reasons, firstly they are cheap and easy to set up compared to other options such as GPS tracking (which in any case is not always accurate for objects that are very close to each other) or more recent technologies such as iBeacons (which have an initial outlay) and secondly because they have a visual presence, which was essential since the aim was to track spontaneous engagement with the technology rather than recruit participants. This had impacts for other areas of the evaluation, such as the ability to collect direct feedback from participants. In fact, data was gathered via Google Analytics. In order to access content, a visitor had to find a QR code that was placed next to the artwork in the museum grounds and scan it using their mobile device (Figure 5.7). This would take them to a landing page, which contained information about the artwork.

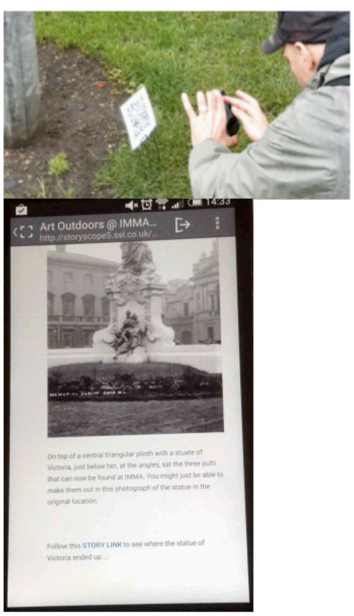

Figure 5.7. IMMA visitor scanning a QR code and one of the landing pages on a mobile device.

A ‘landing page’ was a story section authored in Storyscope. It included a picture of the object and stories associated with the immediate conceptual neighbourhood, such as when the piece was made and who by. To navigate through the extended conceptual neighbourhood, visitors could click on story links at the bottom of the main page. This would take the visitor to a page containing either further background information to the current object, or other conceptually related objects in the grounds. Museum experts used Storyscope to create these landing pages (a story section) for each of the 27 objects in the grounds, plus additional story sections with background information for some of the artworks.

The recommender produced 18 trails from 27 starting points, one for each artwork. The remaining 9 artworks were not found to have conceptually related story sections. The longest trail produced was 6 story sections long. The IMMA experts assessed these and selected 15 to include in the evaluation, 6 with some minor modification. Since the narrative recommender was used to create the trails for the story links, each story link led to a new story section that was conceptually further from the landing page. A trail of story links ended when there were no further sections to include that would maintain the coherence of the trail. In order to find more content, the visitor had to walk to another QR code and scan that to reach a new landing page and new story links. To aid this, at the bottom of each landing page text there was also a brief sentence referring to the extended physical neighbourhood, inviting the visitor to ‘look around! You should be able to see more artworks and QR codes from here' or 'now head up the avenue! You should be able to see more artworks and QR codes along the way.' Thus, the visitor was able to select their own coherent physical path through the physical neighbourhood, yet still access the immediate and extended conceptual neighbourhood of each artwork. They might later come across an artwork for which they have already accessed the related microsite information in the context of an artwork they visited before. They might then also find an online trail similar to one they had seen before, but presented in a different order. No attempt was made to record which content had been viewed by a visitor and tailor/omit content accordingly. Each access through a landing page was designed to be a complete, conceptually coherent experience in its own right and to support the visitor in that moment, regardless of where they had been or where they might go next. For selected artworks there were two versions of the content created, one for adults and one for children. The narrative trails were structurall equivalent, but less complex language was used in the object stories for children. There were two QR codes available at these locations, clearly marked as being either for an adult or for a child.

5.4 Evaluation and Results

The microsite was designed to support visitors who were browsing the grounds, possibly prior to visiting a more structured exhibition within the museum building. Access to the grounds is free and visitors therefore can come and go without having to pass a paying booth. The aim was to find out if these visitors might be tempted to engage with artworks by scanning QR codes, without prompting and without having picked up any leaflets or making any commitment to follow a trail. Visitors could spend as long as they wanted to browsing, and could scan as many or as few QR codes as they liked. Visitors did not have to come into contact with any experimenter and therefore it was not possible to get direct feedback from every visitor, although a link to a survey was provided and some respondents did fill this in. Evaluation was conducted using Google analytics to record and track how the visitors accessed the landing pages and the embedded story links. It was hypothesized that engaged users would explore the narrative using a mixture of physical proximity and story links, reading one section and then another (by following a link) before moving on to the next physically nearest object of interest. In addition, the evaluators sought to test whether visitors would be more inclined to follow location-based prompts (by scanning visible QR codes) or to follow the story links generated through Storyscope's narrative recommender.

The QR code trial was conducted over 2 days. In total 47 separate visitors scanned at least one QR code in this period. 29 of these scanned only one code and did not investigate further. Of the rest, 10 users visited between 2-4 pages, and 8 visited between 6 and 12 pages. As IMMA grounds can be accessed freely by the public, there are no total visitor numbers for this period.

From the Google analytics output it was possible to identify some user journeys of visitors who accessed more than one QR code landing page: both physical journeys between QR codes and conceptual journeys along story links. In Figure 5.8 a visitor visits three story sections. The first section is accessed by scanning a QR code. Next, the user follows a biographical Story Link about the artist. This user then travels to another artwork and reads two separate sections about a single artwork: Ferdia at the Ford. This is both the children's text and the adult's text. In other words, they scanned both codes. This could have been by mistake, or perhaps out of curiosity to see the difference in content.

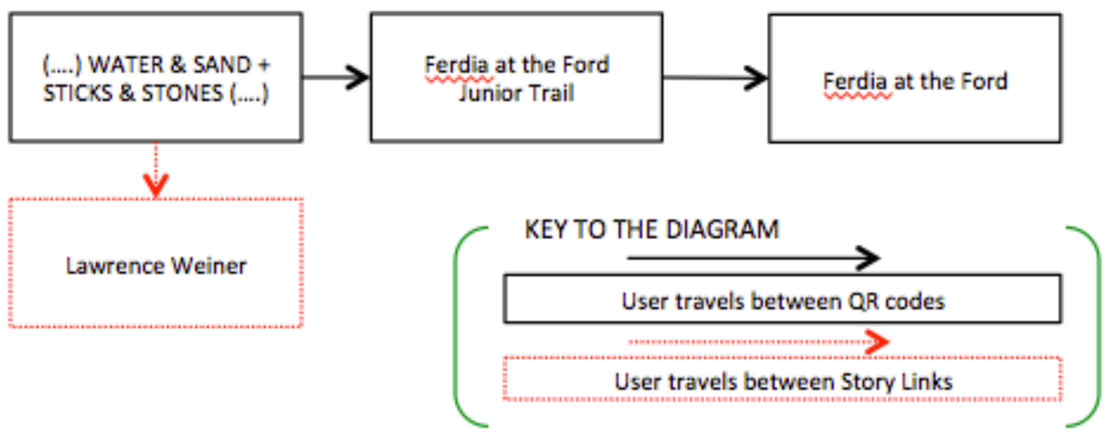

Figure 5.8. A visitor journey through the physical and conceptual space.

In Figure 5.9 we can see the journey of a visitor who doubles back to read about Untitled by Tony Cragg for a second time. Figure 5.10 shows the visitor journey of a highly engaged user who has walked up IMMA's West Avenue from the Kilmainham entrance and then ventured into the Formal Gardens (Figure 5.11), reading many of the recommended sections as they go. In one case, the user drills down through all 4 of the available story links from that point. This visitor can be seen to have followed a linear path, always walking and scanning the next closest item. This visitor was not prompted by the information they read to deviate from this linear route.

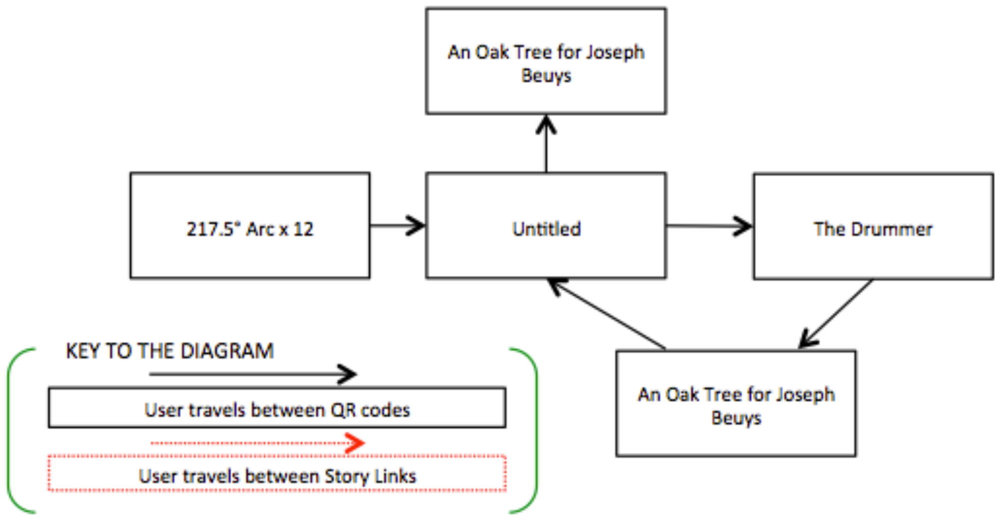

Figure 5.9. The visitor journey of User 16.

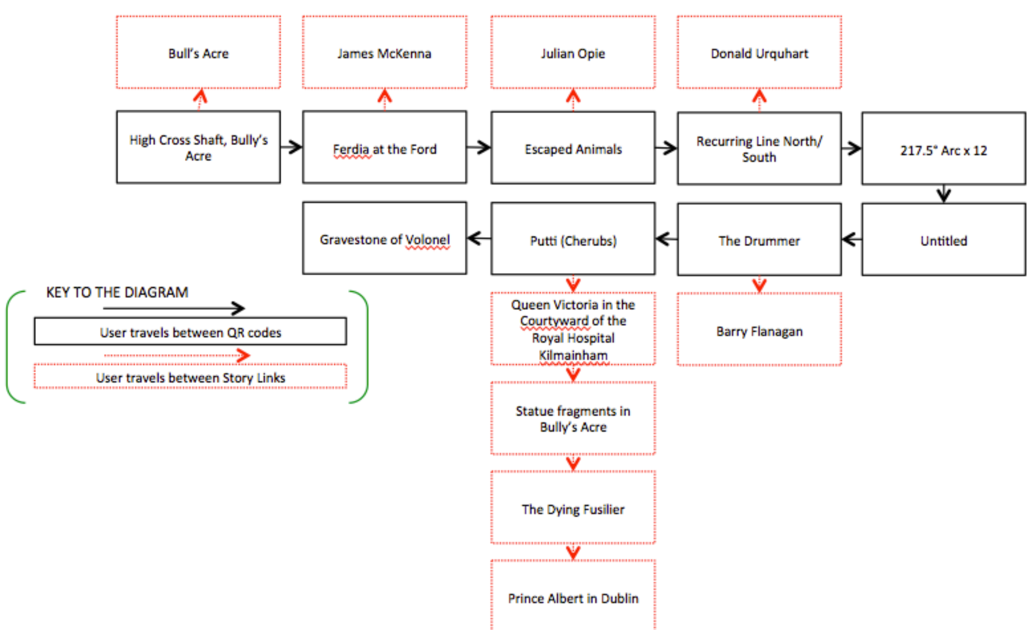

Figure 5.10. The visitor journey of User 21.

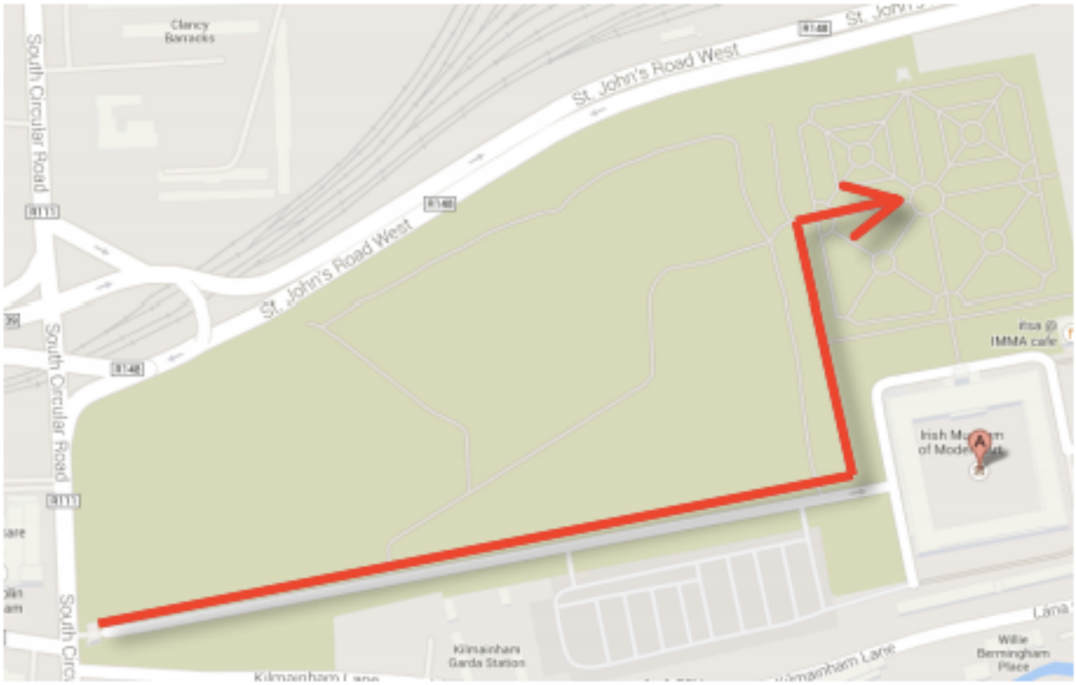

Figure 5.11. The journey through IMMA of User 21.

Given the relatively small number of users who visited more than one section it is difficult to draw firm conclusions about whether physical or conceptual links were generally preferred, since visitors were often scanning different codes to one another, which could affect the story links that were available. However, analysis reveals that visitors who accessed a story link once were quite likely to do so again, whereas those who ignored them from the start continued to do so. Figure 5.12 shows three user journeys. An asterisk indicates that a section was accessed through a story link (those without were the QR code landing pages).

As mentioned previously, many visitors engaged with the QR codes without speaking directly to an experimenter and the survey was optional. Still, a few fairly informal and brief responses were collected through the survey. One respondent noted that they had difficulty downloading a QR scanner. Another liked the technology but felt that the style of information was not engaging. However, generally the feedback was positive. Comments included: “would like to have had more time to explore art trail” “adds more to the experience” “excellent tool” “it is a nice new way to learn more about artworks in the grounds” “Loved it!!” None of the users mentioned that they found the information repetitive or were put off by finding the same information in more than one place. One particular respondent did note that “Maybe I’m not a typical user in that I feel I would want to visit all the QR codes and read about all the pieces available rather than just dipping in and out or cherry picking things”. However, there is no reason why the technology could not be used in this way and in fact interested visitors can choose to pick up a leaflet and follow a specified trail. Or, indeed, the microsite could easily be authored to lead visitors from one artwork to the next, by providing more specific navigation in the space reserved for pointing out the physical neighbourhood. All of the engagement with the technology was fairly ‘impromptu’ and none of the visitors were specifically recruited or led into using the technology, other than possibly having seen the QR code trail advertised on social media. With this in mind, overall, the evaluation seemed to show that visitors were curious to scan and engage with the QR code technology. Many were likely to follow the conceptual links when they were provided and the responses given indicate a positive attitude towards the technology and content.

User Journey 1
217.5° Arc x 12
The Drummer
An Oak Tree for Joseph Beuys
Untitled SENTINEL VIII

User Journey 2
High Cross Shaft, Bully's Acre
*Bully's Acre
Ferdia at the Ford
*James McKenna
Escaped Animals
* Julian Opie
Recurring Line North/South
*Donalld Urquhart
217.5° Arc x 12
Untitled

User Journey 3
217.5° Arc x 12
*Bernar Venet
SENTINEL VIII
Back of Snowman
Burgoyne's Bell from the Royal Hospital Bell Tower
Byzantine
Slatter's Lamp
Signage for a 35 Floor Social Centre
Putti (Cherubs)
*Queen Victoria in the Courtyard of the Royal Hospital Kilmainham
*Putti from the Queen's Statue
Patrick Ireland 1972

Figure 5.12. Three user journeys. The * shows that the page was accessed by clicking a story link. The left-hand user has not opened any story links.

5.5 Conclusions

Museums organise carefully selected content into narrative presentations. However, in museum grounds the artefacts are more likely to have been accrued over time and not for the purpose of a specific narrative. In order to support visitors in experiencing the narrative connections between objects while supporting them to choose their own path through the grounds, a model was proposed that represented objects within both a physical and conceptual neighbourhood, in which objects are navigated either through a physical space using physical proximity as a measure or through a conceptual 'story' space using conceptual similarity, based on narrative principles of setting and theme. The scenario evaluated is that of visitors who are exploring artworks in the grounds of the Irish Museum of Modern Art, in Dublin. The Storyscope environment for supporting museum authoring is applied to the task of creating a microsite for museum visitors. This site has a number of pages that are accessed by scanning a QR code next to a museum object. The landing page contains some information about the immediate physical and conceptual neighbourhood of the artwork, then below this there are story links that the visitor can click to discover the extended conceptual neighbourhood, which might include other artworks in the grounds. Additional text prompts the visitor to further explore the extended physical neighbourhood from the point where they are standing. The QR code trail was evaluated with visitors to the grounds of IMMA. Google analytics was applied to find out what visitors were doing. In terms of sub-question 2 (SQ2) '*how can construction of narratives be supported in a physical space when objects cannot be organized to reflect the underlying narrative?*' the analysis of QR code scans revealed that some participants did follow story links. However, there was no evidence that they would seek out the objects mentioned in the story, instead they could be seen to follow the more obvious linear pathways between items, going to the closest next. This lends some support to the model of physical and conceptual space on which the development of the device content was based, indicating that it makes sense to separate coherent conceptual experiences from coherent physical experiences and to think of them as being different to one another in the way their navigation should be guided. Physical navigation might focus on highlighting the next physically closest location, even if this diverges from leading people along paths of conceptually related content. However, as discussed, there were drawbacks to this study that meant that only minimal feedback was obtained. Therefore, the following two chapters will explore the differences between physical and conceptual narratives, in more detail, through two controlled studies.

6 VIRTUAL TOURIST TRAIL

Chapter 5 introduced a model of physical and conceptual neighbourhoods that could be used to support a visitor in free exploration of a sculpture garden following a physically coherent path, but whereby they could also find stories linking objects distributed across the grounds. An 'in the wild' study was described in which visitors to the sculpture garden accessed stories from their mobile devices by scanning QR codes. The visitor would find information related to the object they were standing by and also learn how it was related to other objects in the same grounds.

This work was based on the following assumptions:

- People are interested in following paths of conceptual proximity, to understand how things are related
- People will naturally follow a path based on physical proximity
- This preference to follow a physically coherent trail will override a persons desire for narrative connections to the extent that they would ignore directions to conceptually related items that would deviate too much from the coherent physical path or that might cause them to miss objects related to the narrative that they happen to pass and which might catch their interest.

Whilst there is literature that supports the development of these ideas and while the findings from the sculpture gardens can be seen to support this model of navigation through physical and conceptual space, there has been little empirical research to really understand how conceptual and physical proximity influence visitor behaviour. What follows is discussion of an experiment that aimed to validate the model.

6.1 Experiment Design

A controlled study was designed to discover how different types of information might influence the order in which people visit a set of virtual tourist sites and their recall of what they had seen. In the study, participants went on a simulated walk around Paris, in which they visited twelve virtual tourist sites. At each site they saw pictures and text related to the site and then scanned a QR code on a mobile device. QR codes were chosen to simulate the sort of location-based information that might be made available to visitors, whilst minimizing technical problems that could disrupt the study related to pinpointing a location accurately in a small, indoor, space. The QR code scan led them to a web page which provided different types of information about the site and in some cases revealed a relationship to one or more of the remaining twelve sites (this depended on which experimental condition they were in). The sites were either points of interest within Paris or else objects that might be encountered in a museum.

Given the nature of the experiment, in particular that all items were in the same room, the overall experience for the participant was more similar from their point of view to a museum visit. The reason for including the larger points of interest was to provide a context within which to prompt participants to also reflect on their tourist preferences and behaviour during city visits. This is based on the idea that the proposed model of physical and conceptual neighbourhoods may equally be used to develop technologies to support city visitors who are visiting multiple points of interest across a city, as in the smaller scale of a sculpture garden. This idea will be revisited more fully in Chapter 7. The aim of the experiment was to verify whether or not people would be inclined to walk out of their way to visit a conceptually related piece, when this information was provided to them.

6.1.1 MATERIALS

Twelve virtual tourist sites were constructed. Each consisted of one main picture and two further related images. The first image was the site itself and the other two provided additional context. In each case there was a small amount of text, mainly taken from Wikipedia (figure 6.1). At the bottom right there was a QR code and an instruction to 'Please scan the QR code below'.

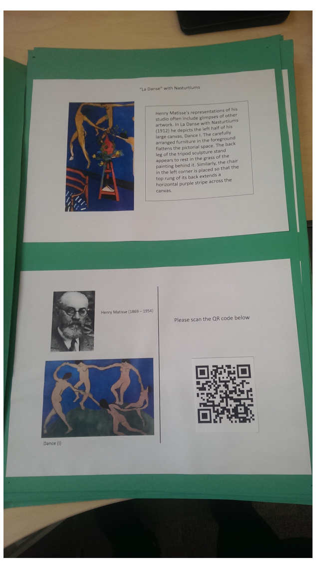

Figure 6.1. A virtual tourist site.

The points of interest were chosen to represent certain themes. Firstly, all selected tourist sites were related to Paris and the mock scenario presented to participants was that they were encountering these pieces on a city tour of Paris. Additionally, the sites were grouped into four ‘independently coherent’ sub groups, each containing three points of interest (POIs) that were conceptually related to each other. To get participants thinking about visiting a city rather than a museum, several sites were chosen that were iconic tourist locations. These were the Eiffel Tower, fountains outside the Georges Pompidou Centre, the Gates of Hell, the Catacombs, a Park (Jardin des Poetes) and the can-can dance associated with the Moulin Rouge. Three of these locations were used for a grouping of items associated with 19th century Paris landmarks and three were used for a grouping of points of interest that were unrelated, other than by being in Paris. A pottery theme was chosen as it allowed items to be thematically linked by type (pottery) but to have different *setting*, i.e. time and place in which they were made. A Henri Matisse set was chosen to have a strong theme, being by the same person and in the same time frame, yet to be of different forms (there were two paintings and one sculpture). Overall, the full set would represent the kinds of items visitors might encounter during a Paris visit, 50% being landmarks and 50% being items that could be found in a museum. The full list of groupings and the themes can be found below.

Group 1 POIs were related to 19th century Paris. This group contained:

1. The Gates of Hell by August Rodin

2. The can-can dance that is associated with the Moulin Rouge
3. The Eiffel Tower

Group 2 were all pottery items from different parts of the world. This group contained:

4. Dish with a lion – pottery from Turkey
5. White earthenware vase – pottery from the UK
6. Socorro red-on-brown jar – pottery from New Mexico

Group 3 items were artworks by Matisse

7. Dance (I) – a painting by Matisse
8. "La Danse" with Nasturtiums – a painting by Matisse
9. Madeleine (I) – a sculpture by Matisse

Group 4 were all places in Paris. This group lacked an internal theme.

10. The Stravinsky Fountain – found by the George Pompidou Centre in Paris
11. The Catacombs of Paris
12. Jardin des Poetes – a public garden in Paris

In each case, the subgroup theme could be derived from the text that was provided with the picture of the site, but was not necessarily explicitly stated here. Whilst three of the subgroups had a definite coherent theme, which could be used for grouping them in a way that would prompt the relationships between them to be quite apparent, there was also obvious thematic overlap between groupings, for example all items were related to Paris, if not directly (for example the UK pottery), then at least by the scenario given to visitors that they were encountered during a city visit to Paris. Six sites were places to visit, the other six were more like exhibits in a museum. The sculpture of Madeleine could be conceptually related by the theme of “French sculpture” to the Gates of Hell. These incidental relationships did not need to be controlled for within the purpose of this study although it was necessary to be aware of them during later analysis.

The information for each virtual site (pictures, text and QR code) was formatted onto two sheets of A4. The picture of the site plus the main text was on the first sheet and the related images, plus short explanatory text for these was placed on the second sheet, along with a space for the QR code. The set of wall materials can be found in Appendix B. The A4 sheets were stuck onto a piece of green card. In this way, the virtual tourist sites all had a similar look and feel, and the only thing that differed was the content itself. A single room was configured so that the virtual sites could be placed either on a wall, or on a poster board, in certain positions and in a way that afforded a linear route, but in which the participants could not always see where the next item might be found through line of site. To ensure this, some of the poster boards were placed across the ‘corridor’. There was one pathway created across the middle of the room linking the left and right sides, so that the participant could more easily get from one side to the other, for example if prompted to deviate from the linear route by information presented on the device (see figure 6.2). To further facilitate participants to navigate around the room, they were given a map showing the location of all the sites. The room was equipped with overhead cameras to film participants as they took part in the experiment. From these cameras it was possible see in which order participants had visited the sites. This method of tracking their movement was chosen to be less intrusive than having an experimenter following and making notes and also being less prone to human error, as the data from cameras could be checked multiple times.

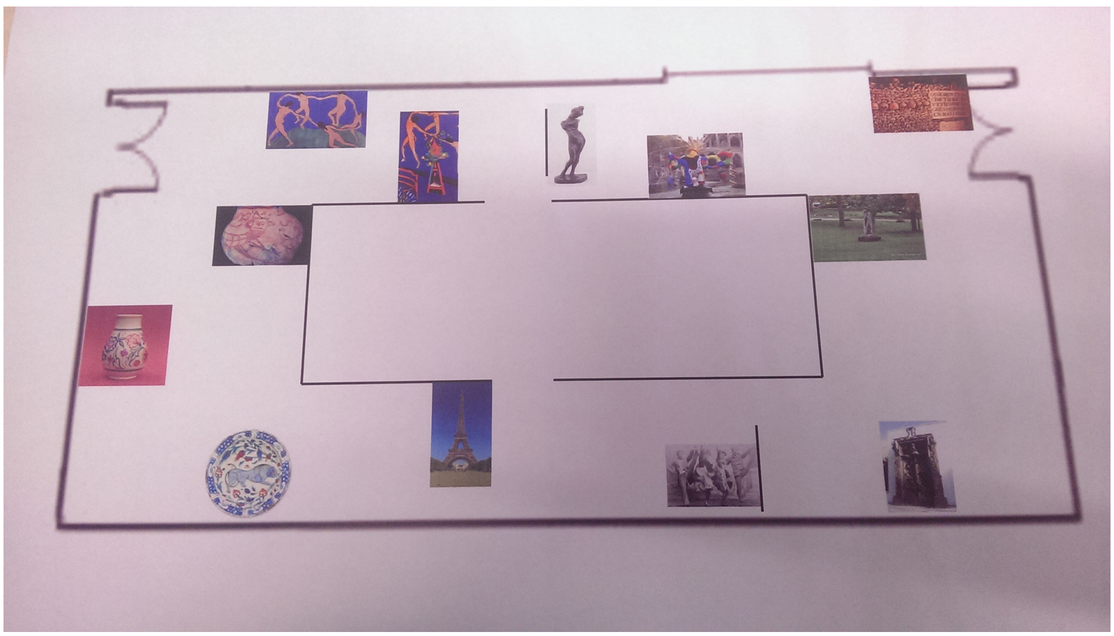

Figure 6.2. An example map given to participants, also showing the room layout.

As mentioned, each site was presented alongside a QR code. QR codes were chosen to simulate the sort of location-based information that might be made available, whilst minimizing technical problems that could disrupt the study related to pinpointing a location accurately in a small, indoor, space. Four versions of a web page were created for each site. Which one was accessed by a participant, and the information that was presented, varied according to which one of four experimental conditions the participant was in. The four conditions were:

C1: Aligning a coherent physical and conceptual path. The coherent linear physical path, as measured by physical proximity, would take visitors in a conceptually coherent order through all sites, i.e. seeing all of sub-group 1, then sub-group 2 etc. Scanning the QR code showed a picture of the site and a brief description that reinforced the theme, and nothing more.

C2: Coherent physical/incoherent conceptual path. Items were organised randomly in the physical space and did not reflect a conceptually coherent order. The random order was obtained via a web-based randomizer by putting in the numbers 1-12. The order was: 2, 12, 11, 6, 8, 1, 7, 4, 3, 9, 10, 5. Scanning the QR code showed the same information as in C1: a picture of the site and a brief description that reinforced the theme, and nothing more. This condition was designed to disrupt the coherent conceptual narrative found in C1.

C3: Coherent physical/incoherent conceptual path but with conceptual similarity revealed via device information. The same random order was used as in condition 2. Scanning the QR code showed the current site and both of the related sites from within the same group, apart from in the 'unrelated' group 4, where nothing additional was shown (see figure 6.3

for an example of how similar items were shown). This condition was designed to assess how highlighting conceptual links might improve understanding of the relationships between items, but the term used ‘similar items’ was deliberately chosen to be neutral as to whether the participant should then seek out the similar item or not.

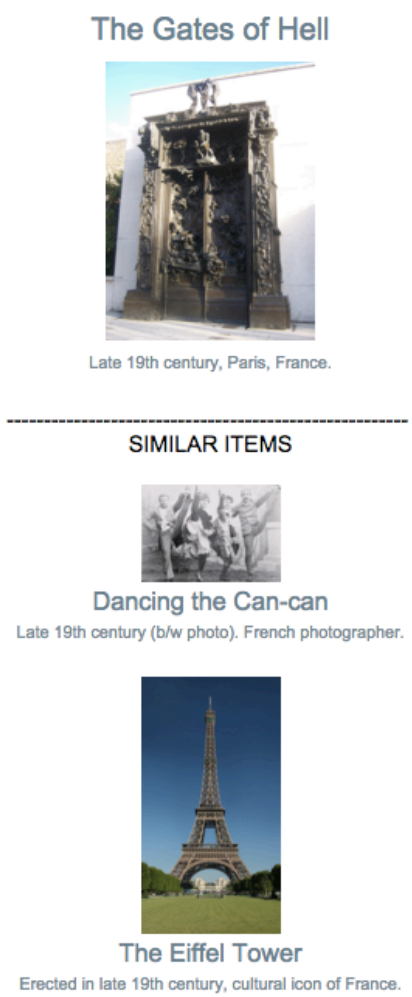

Figure 6.3. Example of a web page accessed via QR code for condition number 3, showing conceptually similar items.

C4: Coherent physical/incoherent conceptual path but with an explicit suggestion on the device to find a related item. The same random order was used as in conditions 2 and 3. Scanning the QR code either made a suggestion for a subsequent conceptually related site to visit (figure 6.4), or, if it was at the end of a group, invited the visitor to look around for something new to explore (see figure 6.5).

Figure 6.4. Example of a web page access in condition 4, giving guidance to a participant on where to go next to see a related item.

The suggested trails were created by taking the next conceptually related item, in order, from the C2 ordering of objects until they had run out. Items 10, 11 and 12 were unrelated to other items and therefore in each case, after visiting the virtual site, the mobile content gave the instruction to look around for something new.

Figure 6.5. Instructing the participant to look around for something new to explore.

This condition was designed to assess whether participants were likely to follow the guidance to visit conceptually related sites and if they did whether this would help or disrupt their ability to perceive the relationships between items. The trails were as follows:

- 2-1-3
- 12
- 11

- 6-4-5
- 8-7-9
- 10
- 11

In conditions 2, 3 and 4 the placement of the virtual sites in the room remained the same, and only the QR codes were changed to point to different information.

Two questionnaires were developed, one to be completed by participants prior to them engaging with the virtual tourist trail and one to be completed afterwards. The purpose of the pre questionnaire was to firstly understand a little a bit about the participants in order to understand whether this could affect interpretation of outcomes, but also to act as a 'prop' to get the participants in the frame of mind to think about their preferences for tourist activities and thus elicit better information on the open ended questions. The post questionnaire was designed to find out what participants recalled from the activity. The questionnaires were delivered to participants using Google Forms.

In the pre questionnaire the main focus was on the participants' normal travel preferences. These questions were:

1. On average how many times do you travel each year for the purpose of a holiday (including trips within the UK)
2. When on holiday, how likely are you to take part in tourist activities (e.g. museums, architecture, parks and gardens)

3. What sort of tourist activities do you like? (Tick all that apply)

    a. museums
    b. art galleries
    c. religious buildings
    d. city breaks
    e. outdoor artworks
    f. architecture
    g. beaches
    h. historical artefacts
    i. modern art and culture
    j. animals and wildlife
    k. music concerts/opera
    l. castles
    m. natural landscapes
    n. historic houses
    o. Other (specify)

4. Have you ever visited Paris?
5. How often do you use audio guides?
6. How often do you download tourist apps?
7. How often do you follow guidebooks?
8. How often do you use a human tour guide?
9. How often do you plan your own tour?

10. How often do you choose your route spontaneously?
11. Which is your preference? (Please choose just one)
    a. audio guide
    b. tourist app
    c. guidebook
    d. human guide
    e. own tour
    f. spontaneous

In the post questionnaire, participants were asked to summarise their trip for someone who hadn't been there and to write down any themes they had noticed. Next they were asked to answer a number of questions that tested their recognition (e.g. 'did you see….) and recall (e.g. what was…). The full set of questions were:

1. Summarise your trip for someone who hasn't been there
2. Write down common themes amongst the places and objects you visited
3. Did you see any UK pottery?
4. Who created the Gates of Hell?
5. Which artist created "La Danse" with Nasturtiums ?
6. Did you see any items about 18th century France?
7. What did you see before you saw "La Danse" with Nasturtiums?
8. In what year was '"La Danse" with Nasturtiums' painted?
9. Where is the Stravinsky Fountain situated?
10. Did you see a Polish dish?

11. What did you see after you saw The Stravinsky Fountain?
12. Is there a statue at the centre of the Jardin des Poètes?
13. What was the original purpose of the Eiffel Tower?
14. Was the Stravinsky Fountain created in 1983?
15. How easy did you find it to scan the QR codes?
16. How useful did you find the information on the mobile device?
17. How likely would you be to scan QR codes to get additional information in the future?
18. How easy was it to navigate between points of interest?
19. How enjoyable did you find the overall 'visit'?
20. What other ways would you like to be given information about tourist sites?
21. What other comments can you give about the overall experience?

6.1.2 EXPERIMENTAL PROCEDURE

Participants firstly went through the consent procedure, in which they were asked to agree to being filmed while participating in the experiment. Participants were then asked to sit at a computer and to fill in the pre-questionnaire. They were told they were able to ask for clarification if they needed it. The pre-questionnaire was completed in a room adjoining the room where the experiment was to take place.

Participants were taken into the room where the virtual sites had been set up on a series of panels. They were given the map that showed where each site could be found and reminded about the presence of overhead cameras that would be tracking their movements around the room.

Figure 6.6. A virtual tourist scanning a QR code.

Participants were provided with an iPad and were asked to scan a 'test' QR code in the presence of the experimenter to demonstrate that they had no technical issues with the equipment. They were told they could leave the room at any time to seek clarification from the experimenter and that this would not invalidate the results. They were all taken to the same starting point and then instructed to begin scanning QR codes for each place in the room, then informed that they could travel any route that they wanted. Figure 6.6 shows a participant inside the room, scanning the QR code. This shot was captured from the overhead camera film. Participants were asked to come back to the first room when they were done. When participants returned, they were asked to complete the post questionnaire and again told that they could ask for clarification on questions if they needed it. When they had completed the questionnaire they were debriefed on the experiment.

6.2 Results

20 participants completed the virtual tour, 5 in each condition. There were 12 male and 8 female participants. The majority (60%) were in the age-range 25-34. Of the remainder, 10% were 18-24, 5% were 35-44, 20% were 45-54, and 5% were 55-64. Only 7 participants had English as a first language, however 18 rated their level of English as either good or excellent, and the other 2 rated it as fair. This data was collected in case there was the possibility of the level of English, or the participant's own confidence in their ability, impacting on their ability to understand the information provided with each site. Eighty per cent of participants had visited Paris at least once in the past.

6.2.1 PRE-QUESTIONNAIRE

To summarise the findings from the pre-questionnaire, the majority of participants travel at least once a year for the purpose of a holiday (rather than work, for example) and overall the participants were likely to take part in tourist activities when they travelled. All participants listed a range of activities that they would participate in, with a lowest of four different types of activity (2 participants) and a maximum of 10 (7 participants). There was an average of 8.25 different types of activities across all participants. The full summary of survey responses can be found in Appendix C.

Taken as a whole, the data collected in the pre-questionnaire suggests that most participants are likely to take part in tourist activities when on holiday, with natural landscapes, architecture, museums and castles being among the most popular tourist activities that nearly all participants would be interested in. The data seems to indicate a preference for self-directed tourist activities, in which travel is self-planned, often spontaneous and occasionally making use of guidebooks. However, use of tourist apps, or human or audio tour guides is less popular.

6.2.2 VIRTUAL TOUR

The footage from the overhead cameras was analysed to identify the order in which each participant visited the virtual sites. The route was annotated on a copy of the map.

All of the participants were left in the room at the same point, which was next to the 'first' item in the trail. This was either the 'Gates of Hell' for Condition 1 in which the physical and conceptual paths were aligned, or the 'Can-Can' for the remaining 3 re-ordered conditions. 19 out of 20 participants scanned this site first. One participant scanned a site that was next to this one, which was nearer to the entrance where the participant and researcher had entered.

The routes taken by participants could be categorized in terms of whether they were linear or not. 15 participants chose a linear route. An example of a linear route is shown in figure 6.17. The numbers 1-n indicate the order in which items were scanned and the arrow shows the route that was walked. While it is hard to draw firm conclusions from such a small sample, this does appear to backup the idea that people will generally select a route based on ‘nearest first’.

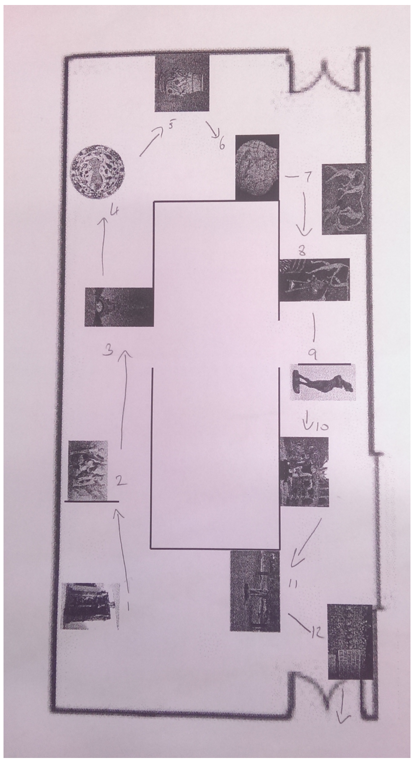

Figure 6.17. A linear route of a participant.

Of the 5 participants who chose a non-linear route, one was in condition 2, two were in condition 3 and two were in condition 4. In condition 3 the device was presenting information that revealed the whole subgroup, but was not explicitly prompting the participant to deviate from their route. In condition 4 the device was giving more explicit prompts towards where a closely related item could be found. It is not possible to explain why the participant in condition 2 did not follow a linear route.

However, these non-linear routes in condition 3 and condition 4 were analysed in more detail to ascertain whether the route coincided with the information that was presented on the device. This analysis revealed that one route in condition 3 and one in condition 4 appeared to be random routes that could not be explained by the prompts that would have been presented on the device.

The remaining participant, from condition 3, had deliberately sought out all of the related items presented on the device before moving onto the next group, therefore seeing items in a coherent order similar to condition 1. This route is shown in figure 6.18. This participant went from the 'Can-Can' directly to the 'Eiffel tower' and then to the 'Gates of Hell' (19^{th} century group). After this, they visited the 'La Danse with Nasturtiums', followed by 'Dance' and then the 'statue of Madeleine' (Matisse group). Next they found the 'Turkish dish with a lion', then 'Socorro jar' and then the 'Poole jug' (pottery group). The remaining 3 items visited by the participants were not part of a group.

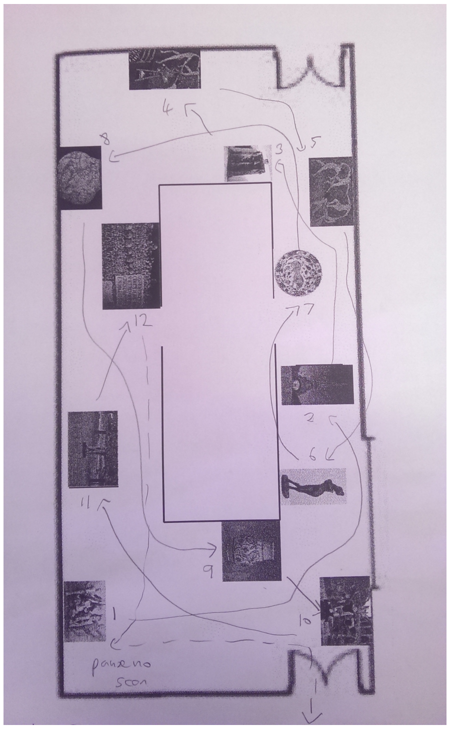

Figure 6.18. A non-linear route of a participant in condition 3.

A participant in C4 appeared to be trying to follow the instruction in most cases, but on one occasion appears to have been sidetracked along the route by a different item, which they then scanned. Their route is shown in figure 6.19.

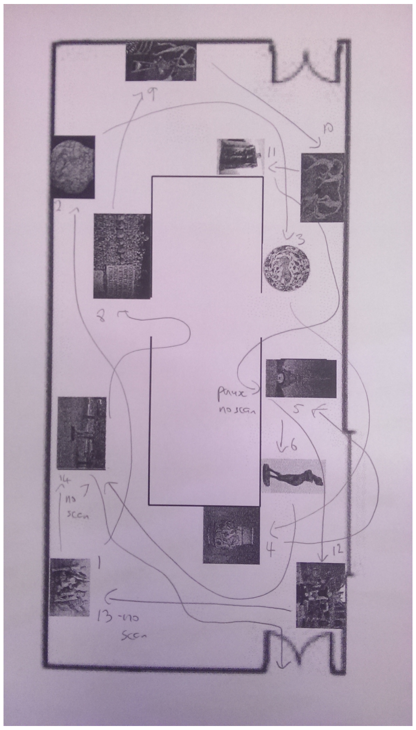

Figure 6.19. A non-linear route of a participant in condition 4.

This participant, therefore, saw some coherent groupings whilst others were disrupted. For example, on scanning item number 1, the ‘can-can’, the participant was prompted to find the Gates of Hell, with the prompt shown in figure 6.20. This participant appears to be walking the correct direction, as shown on figure 6.19. However, they then stopped at the Mexican pottery. Here, they were prompted to find the Turkish dish with a lion (figure 6.21), which they did, as can be seen from their third scan, at the lion dish. They then follow the next prompt, to find the Poole pottery. After this point, the participant follows the prompts for related items. However, in some cases they first encounter an item that is at the end up a trail - for example, they go first to the Matisse statue of

Madeleine. Therefore, instead of being directed towards the other items by Matisse they are instructed to 'Look around for something new to explore', which they apparently do. This could happen because the trails were pre-constructed and were not adaptive to the users' context. Therefore, this participant sees only one entire group, the rest are disrupted.

Figure 6.20. A prompt shown to participant in condition 4.

Figure 6.21. A prompt to participant in condition 4 to find the dish with a lion.

Twelve participants appeared to do a 'final check' after they had scanned the items, presumably to ensure that they did not miss any of the sites. This can be seen by the route in figure 6.22. The participant visits all sites in a linear order, then the dotted arrow shows the additional path they took before leaving the room.

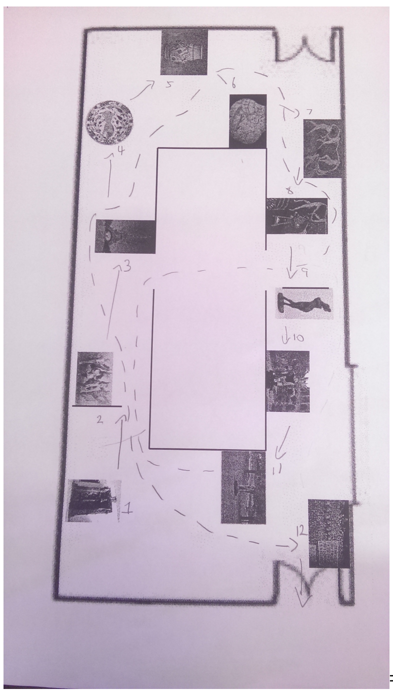

Figure 6.22. A participant doing a final check of the room.

Despite this, some participants did not scan all items. The participant in condition 2 who took a non-linear route missed 2 items. In addition, within each of the conditions 1-4, there was one participant who followed a linear route yet still overlooked one site.

The participant's routes and items scanned were taken into consideration when analysing the data obtained from the post-visit questionnaire.

6.2.2.1 Summaries and themes

Participants were asked to 'summarise your trip for someone who hasn't been there'. The text was analysed to see whether participants would spontaneously mention relationships between the places they saw.

This was identified by the participant either mentioning something about 'items being related' or else by explicitly mentioning some theme that linked items, such as 'crafts', 'pottery' or 'paintings'. In total, 20 out of 20 responses made at least one 'relation' reference, suggesting that when thinking about the visit as a whole, these relationships were quite important to their understanding and ability to talk about it. In the briefest cases, one participant summarized the visit as "interesting trip to some of the sites in Paris" thus recognizing a single relationship related to Paris. Another remarked, "A variety of items, some of which were related, spread across hundreds of years". However, in the other cases the relationships were stated much more explicitly. Examples include (reproduced exactly as written):

> *"I visited a room which had 12 pictures of sculptures, ornaments and buildings. The vast majority of the pictures related to Paris - either the creator was from Paris or they are displayed in Paris".*

"The exhibition brings you around historical and other significant parts of Paris, and explores cultural and architectural features of the city. Some parts of the exhibition are linked with each other, forming a nice path to follow. Particularly ironic was the link from the gates of hell to the Eiffel tower..."

"It is a mixture of various types of sights, especially information about selected sights in Paris, and with some focus on the work of H. Matisse that is available in one of the museums in Paris and some pottery work across different continents, America, Europe, Asia."

Participants were then asked to 'Write down common themes amongst the places and objects you visited'. There were no obvious differences between the conditions in terms of the answers given here. Nearly all participants were able to identify some themes from amongst the sites they saw. One participant only commented "I liked the idea of having a description and example section in each picture. It makes [it] easier for me to know more about the locations.". The common themes mentioned are listed in table 6.1, along with the number of times they were mentioned. Themes that were only mentioned by one participant were omitted.

Theme	Number of mentions
Paris	8
art	8
sculpture	5
painting	5
pottery	5
Matisse	5
architecture	4
dance	2
19th century	2
20th century	2
artists	2

Table 6.1. Common themes that were mentioned.

6.2.2.2 Recognition and recall questions

The answers to questions were, where necessary, scored according to the route taken by the individual participant. For example, if the participant had been asked 'What did you see before you saw "La Danse" with Nasturtiums?' they were scored as giving a correct answer when they answered with the site they had scanned or paused to look at immediately prior to when they encountered "La Danse". Each participant therefore received a mark out of 15 that was based on their own personal experience. These scores were averaged within each condition. This showed an interesting trend. Participants in conditions where they either visited in a coherent order (C1) or were presented with coherent groupings regardless of their physical path (C3) tended to get higher mean scores (5.4 and 5.2, respectively) than participants who either visited in a random order (C2) or were directed to follow the conceptual path (C4) (4.4 and 3.6, respectively). Due to the small number of participants in each group it is not possible to say whether this result is statistically significant or not.

In fact, the experience in C2 and C4 was often similar, because many participants chose not to follow the recommended order. These findings could suggest that whilst conceptual coherence can help recall in some situations, such as when the physical and conceptual path happen to align, or when a visitor follows a coherent physical path in a physical space and a coherent conceptual one on a device, there may be some disruption when a tourist is prompted to take non-coherent physical path in order to experience a cultural narrative in a coherent conceptual order. This could be due to tourists being sidetracked by other points of interest while they are travelling between the conceptually related sites and making detours.

6.2.2.3 Feedback on the experience

The remainder of the questionnaire focused on eliciting feedback about the experience. Some of this data is summarized in table 6.2, which provides a mean score for the responses that were given on a scale of 1 – 5. This revealed that participants did not have problems with scanning QR codes, or navigating between the sites. However the majority did not find the information presented there useful, regardless of which condition they were in. Despite this, they were reasonably likely to scan QR codes in the future.

Question	**Average score**
How easy did you find it to scan the QR codes?	4.7
How useful did you find the information on the mobile device?	1.78
How likely would you be to scan QR codes to get additional information in the future?	3.45
How easy was it to navigate between points of interest?	4.15
How enjoyable did you find the overall 'visit'?	3.75

Table 6.2. Summarising responses of feedback.

Looking at the more detailed feedback, participants mentioned a range of ways in which they would like to receive information about tourist sites. In addition to a number of mentions of guide books, or leaflets, participants also mentioned wanting to understand how places were related, or to have a story. Examples include (reproduced exactly as written):

> "*I would like that after visiting a site it gives me suggestions about what place visit nexy so I can ""follow"" a meaningful route.I would like a more interactive information, in which I can click and discover more things after scanning the QR code.*"

“I like relationship among different things that I see, which then makes it easier to make the whole picture about the tour.”

"Touch screen that provides a sort of interaction activity (learnign game perhaps) about the exhibiton item. Audio guide (but needs to be tell a story rather than just listing facts of items exhibited).Mobile app (just like the ipad provided now)"

“Rather than simply listing related sites, more information about the nature of the link would have helped to determine if it is likely to be interesting.”

"I would like the QR to situate the tourist site between other variables (map, stories about it, etc) and make it easier for me to remember. Also, keep this information saved while visiting a site of similar interest.When used in a building, it would be nice alongside the similar tourist sites to also provide directions to that site (e.g. ""take me there"" button).”

"I respond better and retain more information when given in an entertaining way (via human tour guide - someone you can ask questions of) OR, if I am able to find more information when scanning QR codes, which simply showed a picture. An interactive map could help. E.g. When the first Matisse artwork

QR code is scanned, it provides you with some background information, after which you are given information about the second art peice and are directed towards it."

A further participant also proposed an interactive map integrating information from several sources, but did not clarify which sources they were thinking about. It should be noted that in this case, two participants did mention that they would like to be directed towards a related piece. Of these two participants, both had taken a linear route. One had been in condition 1, where the coherent narrative and physical path were aligned. The other was in condition 4, where the device was sometimes giving directions to a related piece. However, this participant had not in fact followed the prompts on the device, which seems at odds with their later suggestion.

Participants were asked what comments they could give about the overall experience. Once again, participants made references to stories and relationships between sites. These included:

> *"I wasn't sure if there was a clear narrative to the sequence of items that I viewed, I liked it when pieces referenced each other <rest of comment omitted>"*

"It was interesting to be able to build up a picture of the sort of attractions that were available, and to see how together they form a cultural narrative. It was also interesting to read about links to distant attractions, although obviously in the circumstances it's not possible to make use of that. However, it's not necessarily always desirable to choose another site that is similar to the one I most recently visited. It's easy to get sidetracked and lose the trail. Also, it can be nice to mix things up a bit, then come back to a subject. It would have been nice to be able to keep a note of attractions I intended to visit - although obviously in the context of the experiment it was easy to keep these things in my head, in real life it would not."

"It took me some time to realize that places shown on tablet can also be found in the room. I revisited some places again to get more details and connections between interrelated places."

"Connecting tourist sites with other similar is really useful as you are trying to find what the link between the sites is. For example, I was trying to figure out what the link between a turkish and a french pottery was. I think in the end the only link was that they were both potteries. Maybe there should be a line of text explaining why and how these are similar."

"I did not realise at first that the mobile content gave a pointer to a related point of interest, I noticed it the second time around. I think it's a nice way of creating a story line, a way to guide people through visits.I was a bit surprised that links were not two-way, that is the gate of hell linked to the Eiffel tower, but the Eiffel tower did not link to the gate of hell. In hindsight, it makes sense, but maybe bidirectional information (making it explicit) would serve visitors better."

"there didnt seem to be a common theme linking all the interest points together. they were all loosely linked with France but there was no clear link from one item to the next (if you followed them in the order presented). I tried to see if i did something wrong by not following the suggested routes but the ipad app seemed to link items in a weird way (i.e. can-can dance and the gate to hell) or give ambicuous instructions like ""points of interest around you"".The ipad quicly became a burden to my experience; something i had to carry around with me just because someone gave it to me."

It is worth noting that the participant who mentioned that the iPad became a burden was in condition 4, in which the participants would experience a disrupted route from trying to follow the suggested trail, or to try to find and pick up a new trail when they had reached the end of one.

In addition to the above, participants often mentioned across many of their free-text answers to questions, and across all of the experimental conditions, that they expected to see more from the QR codes. These comments occurred in all conditions. Participants variously wanted bigger images, 3D models of objects, more information and stories about the place, and more interactivity.

Overall, when participants were giving comments, whether in summarizing the trip, identifying themes, discussing different ways to be given information about tourist sites, or simply commenting on the experience as a whole, a common theme that came up was the idea of understanding how the items were related. As discussed before, in all cases participants appeared to be trying to make sense of the overall experience by identifying common themes that they could then use in a structured narrative summary. Participants were not simply reeling off a descriptive list of places they had visited.

6.3 Conclusions

An experiment was conducted in which participants visited 12 mocked up tourist sites of Paris on a virtual tour. Participants scanned a QR code at each site, which gave them some information on an iPad, which either showed just a picture of the site they were standing at, or else showed them, in one of two ways, how the places were related. The overall aim of the experiment was to see to what extent visitors were inclined to take a non-linear path, and how often this was related to some prompting from the information on the mobile device. A further aim was to find whether either visiting POIs in a conceptual order, or finding how sites were conceptually related by seeing them presented each time as coherent groups on the device, even when they weren't visited in that order, would help recall or lead to better stories after the visit than if sites were visited in a non-conceptual order. A further aim was to discover whether being prompted to follow a conceptual route at the expense of following a more coherent physical route might in fact disrupt recall.

Participants tended to follow a linear path. The coherence of the experience, where they either encounter objects in a coherent order or else are given coherent order on a device, appears to have a small effect on memory unless the participant tried to use the information provided to visit places in a coherent order. The stories written by participants after the visit reveal that in all conditions participants were attempting to understand the thematic connections of the places they had visited. Further, many participants made an unprompted indication that they were specifically trying to understand the relationship between the places they visited, with a large number mentioning that they found these sorts of stories interesting and were the sort of thing they were looking for on their visit. The majority of participants indicated that they were likely to choose their route spontaneously during a tourist visit, despite often also using guidebooks or taking tours.

The study was designed to answer the question (SQ3) '*What effect do different types of prompt have on decisions made about navigating multiple points of interest?'* Overall, the findings suggest that visitors like to choose their own route, will often favour a physically coherent route and therefore will take the shortest path between places. They tend to ignore prompts to visit places just because they have a conceptual relationship, yet find it interesting to know how places are related and in fact tend to remember their visit in terms of at least the broad categories of places they visit.

From the above, it could be suggested that if people are not inclined to deviate from their route within the small space of the experimental lab, then they are not likely to walk a larger distance across city. There is some possibility that in the small space and given a smaller time span, people may be making a judgement not to deviate on the basis that they will see the piece soon, anyway. This implies that when greater geographical distances and walking times are involved, what would motivate people to follow guidance to visit a conceptually related place would be the worry that if they didn't travel directly there, they would be unlikely to recall that there was a connection between the two places. This seems unlikely, but could in any case be evaluated in a further study similar to the one described here, but in which participants are asked to explain their choice of route.

7 FOURSQUARE ANALYSIS

A model has been proposed in Figure 5.5 to support the navigation through both physical and conceptual neighbourhoods of objects during cultural visits. This model proposes that in the physical space people favour using ideas of physical proximity to guide their navigation. In the conceptual space, people use conceptual proximity (using some measure of conceptual distance) to provide a coherent route amongst a set of objects or places.

The previous two chapters have focused on evaluating aspects of this model either ‘in the wild’ in a sculpture garden within the grounds of a museum in Ireland, or in a controlled setting, as participants in a study navigate around a room during a virtual tour of Paris. Overall, the findings seem to confirm both a preference for using physical proximity to guide navigation in the real world as well as a desire to understand, via narrative connections, how places are related conceptually.

It is now considered how far the model might extend to support other activities, for example to support the activities of tourists visiting a city and going to see a number of points of interest (POIs). In this case, the city delineates the physical neighbourhood. This idea was first introduced in the previous section, in which the virtual tour was framed as a tour around a city in order to elicit from participants some information about their general touristic preferences.

Tourists often visit cities with only a limited time and therefore aim to see what they can in the available timespan, especially to visit the most popular sites in that location. To support this, many tours can be found that appear to be produced on the basis of providing a linear route amongst a set of available points of interest, regardless of if, or how, they are related. Similar to a sculpture garden, points of interest within a city develop over time. They are not acquired as part of a narrative, yet narratives *can* be found to exist. These may be reflected through city tours, in which points of interest are chosen according to an overarching theme, for example tours based on architectural style, or around the lives of famous people who lived or worked in a city. As in the sculpture garden example, tourist sites are not portable and the order cannot be manipulated to reflect narratives (as they can in a museum). So, it is unlikely that the physical and conceptual paths will align such that a tourist can encounter a story in both a physically and conceptually coherent order.

Therefore, in most cases, whether navigating between a set of themed or un-themed places of interest any internal narrative connections that exist between points of interest may be either supported or disrupted by the physical layout of the city, which in turn affects the chosen route or tour construction. Tourists generally rely on materials such as guidebooks or tour leaflets to access the stories that link places in the town. Thus, the case of the sculpture garden is quite similar to the case in the city and a similar model might be used.

7.1 Navigating physically and conceptually around Stratford Upon Avon

The above points are now illustrated using the example of Stratford upon Avon, a town in the United Kingdom. William Shakespeare was born in this town. In fact, his birthplace is found there and is attached to a small museum. Shakespeare lived much of his life in Stratford Upon Avon. It is possible to also visit (amongst other places): his daughter's house Hall's Croft where she lived with her husband, Dr. John Hall; the cottage that was owned by his wife Anne Hathaway; his grave, which is found inside a local church. Each of these places is linked to a different time in his life.

Thus, a narrative of Shakespeare's life can provide a way to conceptually traverse between a set of physical points of interest. For example, providing an ordering of places according to a timeline of his important life events, such as would appear within a written account of his life. Figure 7.1 shows this mapping between a timeline of Shakespeare's life and points of interest in the town of Stratford upon Avon.

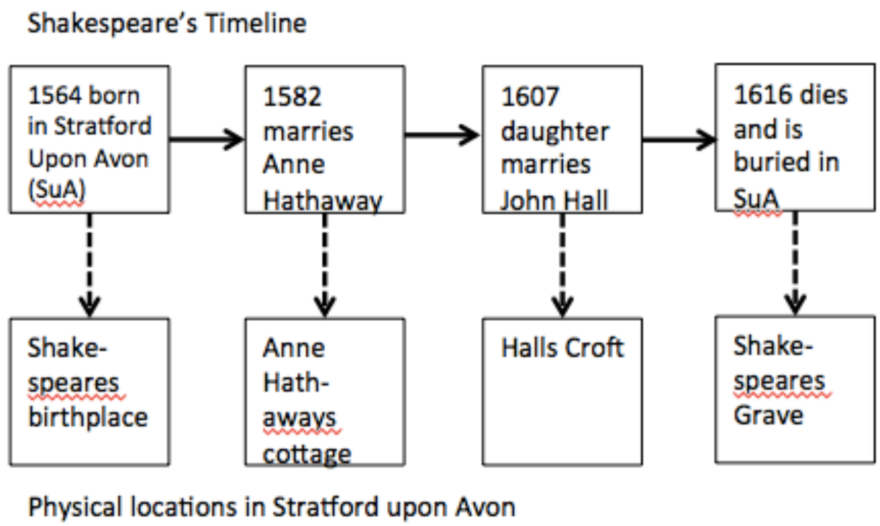

Figure 7.1. Mapping between a timeline and points of interest in Stratford upon Avon.

Figure 7.2 shows key tourist sites of Stratford upon Avon on a map, including the four already mentioned. From this map it can be seen that while it would be possible to follow a coherent physical and conceptual route taking in Shakespeare's birthplace, Anne Hathaway's cottage, Halls Croft and Shakespeare's grave, the visit to the cottage takes the visitor some distance out of town. It is also likely that visitors would want to visit the other key tourist locations while they were there, such as the Swan theatre.

Figure 7.2. A map showing key tourist sites within Stratford upon Avon.

7.2 Understanding tourist behaviour through Foursquare data analysis

An analysis of Foursquare 'next venue' data has been undertaken in order to understand better, from real data, what factors may be influencing navigation choices of tourists in three different towns. Foursquare is a popular tool through which users can check-in to the venue they are visiting. Whilst not every visitor to a town will use Foursquare, or if they do they may not always check-in to every place they visit, the quantity of users means that it is a useful way to get data from which to analyse the behaviour of large numbers of inhabitants or visitors to a city. Previous research using Foursquare check-in data has focused on predicting where visitors will go next, using features such as popularity of venue, distance between locations and individual's past behaviour (Noulas et al., 2012). However, from the literature that has been reviewed within this thesis, to date there has been no attention paid to discovering to what extent conceptual similarity between places - which could indicate a desire to experience a town as a 'coherent narrative' - is influencing the observed tourist behaviour through the physical space.

In the study described here, Foursquare next venue data has been analysed for three tourist towns in the U.K.: Bath, York and Stratford Upon Avon. These towns have been chosen for being popular tourist destinations in the U.K. and for having a number of tourist sites located within reasonable walking distance of each other. For this reason, many visitors will travel to the town with the goal of visiting a number of these sites consecutively and within a relatively short period of time. In addition, each town contains a number of sites that are quite closely related, for example through common people, time periods, or themes as well as a number that are dissimilar. Unlike previous studies, this one will also look at the effect of conceptual proximity of places on the observed visitor behaviour.

7.3 Experiment Design

Each of the three towns being analysed contains a set of tourist sites which people could check-in to using Foursquare. The aim of the experiment was to discover, for each main attraction, where visitors were mostly likely to go next and whether this was the closest a) physically and/or b) conceptually compared to the other possible destinations.

The overall procedure was as follows:

1. Draw up a list of tourist attractions in the area
2. Use Foursquare API to return the most popular next 5 venues, in ranked order for each venue
3. Calculate the physical distance between all attractions in the town
4. Calculate the conceptual distance between all attractions in the town
5. Analyse the data to identify whether physical or conceptual proximity has the most influence on where visitors go next

Each of these steps is now analysed in more detail.

7.3.1 FINDING IMPORTANT ATTRACTIONS AND THEIR MOST POPULAR 'NEXT VENUES'

A process was developed for finding the main tourist sites within each town. Firstly, Tripadvisor (www.tripadvisor.co.uk), was used to identify the number 1 'thing to do' in each location. Tripadvisor was chosen as it is very straightforward to filter by type of venue to identify the number 1 most popular within a given category. So, it was easy to find the most popular tourist site, as opposed to bar or restaurant. Also, accuracy was not critical at this stage - it was only necessary to find a starting point that would be a common place for visitors to the town. For York, the starting point was the "National Railway Museum", in Bath it was the "Roman Baths" and in Stratford upon Avon it was "Anne Hathaway's Cottage".

For each town, the corresponding Foursquare venue ID of the top attraction was found by manually searching the Foursquare interface. This venue ID was then used within the Foursquare API. This API call returns, in order, up to 5 venues that were most commonly checked into next by Foursquare users. An example API call was as follows:

```
https://api.foursquare.com/v2/venues/4b6d7961f964a520db762ce3/nex
tvenues?oauth_token=5WC1YH452WSSRQLTRQPXRKDRX5LUEGOOYEJLABQKXDFIO
QJE&v=20141222
```

This API call returns, in a JSON feed, the rank order list of the venues that are most commonly checked into after the one that was specified by its ID in the API call. Some attributes of each venue are also returned, including the type of venue, latitude and longitude, a check in count and a user count. An example output, from the above API call for Anne Hathaway's cottage, can be found at the beginning of Appendix D. This shows that the next most popular venue to check into after Anne Hathaway's cottage is Shakespeare's Birthplace, then after this it is Mary Arden's Farm, then the Royal Shakespeare Theatre, etc.

This process was repeated iteratively on each item in the list, until only previously found venues were being returned. In some cases, a list returned a venue that was either a bar or restaurant. It was found that in these cases the next venues from the bar, or restaurant, was a further list of bars or restaurants rather than tourist attractions. Similarly, some venues were cafes, such as "Bettys Cafe Tearooms" in York. In this case, the next venues *were* tourist sites. Some research into these places revealed that somewhere like Bettys tearooms is thought of as a tourist attraction within the town, as much as a place to eat, and it is likely to appear in a guidebook as a place to see. However, the bars - or even some of the coffee shops - are not considered in the same way. On this basis, a decision was made to omit bars or cafes that did not have a 'tourist attraction' profile. In addition, some lists included a check-in to the town itself, indicating that a visitor would check-in first to the venue and then make a check-in to note that they were in that particular place. Also, some tourist sites that were some distance out of town, for example Stonehenge, were returned as the next place checked into by some visitors to Bath. Both 'towns' and 'out of town' venues were left out of the analysis on the basis that they were either outside what was defined as the physical neighbourhood (this being the boundary of the town) or else the granularity was too large (in the case of the town itself).

Overall, this process yielded a list of popular venues for each town. These lists were verified against the ranked Tripadvisor list of "Things to Do" to ensure that popular venues had not been omitted. The full lists obtained from this analysis can be found in the second half of Appendix D.

This same process had also provided the necessary ranked lists of most popular venues to check into from each location in the town, as well as other useful data returned within the JSON, such as the latitude and longitude for plotting each place on a map.

7.3.2 Calculating Physical and conceptual distance

In the next step, a physical distance matrix was constructed for each town, showing the physical distance between each pair of attractions as given by Google maps.

A conceptual distance matrix was also constructed for each town. The goal was to identify how conceptually similar two places were, for example whether they were in the same time period, were linked to the same people or used for the same purpose. The conceptual distance was calculated by first extracting entities from the Wikipedia page associated with each POI using alchemyAPI entity extraction (http://www.alchemyapi.com/api/entity-extraction), a service which identifies people, companies, organisations, cities and geographic features from provided text and returns them in the format specified via the API call. The reason for using AlchemyAPI to extract entities was so that in the next step, the conceptual similarity could be calculated based on the narratively important elements of the text (the people, places, objects) rather than simply on common words. An example of an API call used was as follows:

```
http://access.alchemyapi.com/calls/url/URLGetRankedNamedEntities?
apikey=' . $apikey . '&outputMode=json&url='.$url;
```

Where the $apikey was requested via the AlchemyAPI website and the $url was the url of the Wikipedia entry for the tourist site. The output format was specified as JSON. A short PHP script was constructed to automate this process across the set of Wikipedia pages associated with each town. A sample of this code can be found in Appendix E.

This yielded a list of concepts associated with the place, which was converted into a vector. An example of a vector produced by applying this process to the Wikipedia page about Anne Hathaway's cottage (https://en.wikipedia.org/wiki/Anne_Hathaway%27s_Cottage) is shown below:


```
({'Shakespeare': 2, '1': 2, 'Birthplace': 1, 'Newlands': 1,
'house': 1, 'mile': 1, 'Anne': 1, 'William': 1, 'Farm': 1,
'Warwickshire': 1, 'acres': 1, '6': 1, 'Bartholomew': 1,
'hectares': 1, '90': 1, 'Shottery': 1, 'Hathaway': 1, 'England':
1, '36': 1, 'km': 1, 'the': 1, 'Trust': 1})
```

Conceptual similarity was calculated using cosine similarity of the vector pairs. Cosine similarity gives a measure of the proximity between two vectors. In this case, the vectors each represent a set of 'narratively important' terms associated with the Wikipedia entry for each point of interest. Proximity in this case would mean that there was either more, or less, overlap of key narrative terms found through the Alchemy API entity extraction and could therefore be used to approximate how conceptually similar they were, e.g. they are related to the same people, architectural period, building use etc. The calculation of cosine similarity in this case was automated using a brief python script, and using a python function 'get_cosine' which applied the cosine similarity algorithm to each pair in turn and printed the result. This yielded the measure of cosine similarity that was placed into the matrix. An example of this python code can also be found in Appendix E. The cosine similarity returns a value between 0 and 1, with numbers closer to 1 representing more similarity and those closer to 0 representing less similarity. Since the similarity is calculated from vectors consisting of entities that are also related to narrative principles of place, and theme, then there can be said to be a higher narrative similarity between places with a higher number. However, it should be noted that temporal proximity is not calculated, since alchemyAPI does not extract temporal information from the Wikipedia pages. Therefore, the full narrative *setting* information is not being used in this case, but is at least partially represented through the *people* that are returned through the entity extraction, since their lifespan encompasses a certain period of time.

7.4 Results

The information obtained from Foursquare was overlaid onto the physical and conceptual distance matrices that had been created for each town, using colour coding to show - from each POI - the ranked order of most likely places that a tourist would visit next. By further identifying within each row of the matrix which was the physically closest, or conceptually closest (depending on the matrix) it was possible to build up an understanding of what might be guiding visitor behaviour in choosing their next venue. These results are shown in Tables 7.1-7.6, each of which also includes a key to the places. It should be noted that in Table 7.1, showing physical distance between places in Stratford upon Avon, that there is a distance of 0 between Shakespeare's birthplace and the Shakespeare Centre. These places are adjoining and this is taken into consideration during the analysis due to the possibility that visitors would not consider them separate places to check into.

	AHC	SB	MAF	RST	TSC	NHNP	ST	SG	HC
AHC	0	1.2	3.1	1.4	1.2	1.1	1.3	1.2	1.1
SB	1.2	0	3.3	0.3	0	0.3	0.4	0.6	0.5
MAF	3.1	3.3	0	3.6	3.3	3.6	3.6	3.8	3.7
RST	1.4	0.3	3.6	0	0.3	0.3	0.2	0.5	0.4
TSC	1.2	0	3.3	0.3	0	0.3	0.4	0.6	0.5
NHNP	1.1	0.3	3.6	0.3	0.3	0	0.2	0.3	0.2
ST	1.3	0.4	3.6	0.2	0.4	0.2	0	0.3	0.3
SG	1.2	0.6	3.8	0.5	0.6	0.3	0.3	0	0.1
HC	1.1	0.5	3.7	0.4	0.5	0.2	0.3	0.1	0

Table 7.1. Physical distance matrix for Stratford upon Avon (note the '0' for The Shakespeare centre - which is adjoining Shakespeare's birthplace - and the annotation of the 'next closest' places).

AHC – Anne Hathaways Cottage
SB – Shakespeare's Birthplace
MAF – Mary Arden's Farm
RST - Royal Shakespeare Theatre
TSD – The Shakespeare Centre
NHNP – Nash's House and New Place
ST – Swan Theatre
SG – Shakespeare's Grave
HC – Hall's Croft

Key

closest venue
1st most likely visit
2nd most likely visit
3rd most likely visit
4th most likely visit
5th most likely visit

	AHC	SB	MAF	RST	TSC	NHNP	ST	SG	HC
AHC	1.00	0.34	0.41	0.20	0.43	0.43	0.21	0.11	0.18
SB	0.34	1.00	0.37	0.20	0.58	0.36	0.23	0.21	0.27
MAF	0.41	0.37	1.00	0.23	0.56	0.36	0.26	0.09	0.13
RST	0.20	0.20	0.23	1.00	0.35	0.18	0.60	0.10	0.10
TSC	0.43	0.58	0.56	0.35	1.00	0.38	0.41	0.21	0.37
NHNP	0.43	0.36	0.36	0.18	0.38	1.00	0.22	0.13	0.28
ST	0.21	0.23	0.26	0.60	0.41	0.22	1.00	0.16	0.19
SG	0.11	0.21	0.09	0.10	0.21	0.13	0.16	1.00	0.37
HC	0.18	0.27	0.13	0.10	0.37	0.28	0.19	0.37	1.00

Table 7.2. Conceptual distance matrix for Stratford upon Avon.

AHC – Anne Hathaways Cottage
SB – Shakespeare's Birthplace
MAF – Mary Arden's Farm
RST - Royal Shakespeare Theatre
TSD – The Shakespeare Centre
NHNP – Nash's House and New Place
ST – Swan Theatre
SG – Shakespeare's Grave
HC – Hall's Croft

Key

closest venue
1st most likely visit
2nd most likely visit
3rd most likely visit
4th most likely visit
5th most likely visit

	NRM	YM	BCT	MG	TS	CT	YSM	YCM	JVC
NRM	0	0.7	0.8	0.6	0.9	1	0.8	1.1	0.9
YM	0.7	0	0.1	0.2	0.3	0.5	0.2	0.6	0.4
BCT	0.8	0.1	0	0.2	0.2	0.4	0.3	0.6	0.3
MG	0.6	0.2	0.2	0	0.3	0.4	0.2	0.5	0.4
TS	0.9	0.3	0.2	0.3	0	0.3	0.4	0.4	0.2
CT	0.8	0.5	0.4	0.4	0.3	0	0.6	0.1	0.1
YSM	0.8	0.2	0.3	0.2	0.4	0.6	0	0.8	0.5
YCM	1.1	0.6	0.6	0.5	0.4	0.1	0.8	0	0.2
JVC	0.9	0.4	0.3	0.4	0.2	0.1	0.5	0.2	0

Table 7.3. Physical distance matrix for York.

NRM – National Railway Museum
YM – York Minster
BCT – Bettys Café Tearooms
MG – Museum Gardens
TS – The Shambles
CT – Clifford's Tower
YSM – Yorkshire Museum
YCM – York Castle Museum
JVC – Jorvik Viking Centre

Key

- closest venue
- 1st most likely visit
- 2nd most likely visit
- 3rd most likely visit
- 4th most likely visit
- 5th most likely visit

	NRM	YM	BCT	MG	TS	CT	YSM	YCM	JVC
NRM	1.00	0.14	0.04	0.24	0.03	0.09	0.33	0.20	0.12
YM	0.14	1.00	0.10	0.45	0.17	0.38	0.40	0.40	0.30
BCT	0.04	0.10	1.00	0.13	0.08	0.11	0.17	0.15	0.09
MG	0.24	0.45	0.13	1.00	0.11	0.42	0.69	0.53	0.35
TS	0.03	0.17	0.08	0.11	1.00	0.13	0.11	0.14	0.11
CT	0.09	0.38	0.11	0.42	0.13	1.00	0.36	0.49	0.27
YSM	0.33	0.40	0.17	0.69	0.11	0.36	1.00	0.54	0.37
YCM	0.20	0.40	0.15	0.53	0.14	0.49	0.49	1.00	0.37
JVC	0.12	0.30	0.09	0.35	0.11	0.27	0.27	0.37	1.00

Table 7.4. Conceptual distance matrix for York.

NRM – National Railway Museum
YM – York Minster
BCT – Bettys Café Tearooms
MG – Museum Gardens
TS – The Shambles
CT – Clifford's Tower
YSM – Yorkshire Museum
YCM – York Castle Museum
JVC – Jorvik Viking Centre

Key

closest venue
1st most likely visit
2nd most likely visit
3rd most likely visit
4th most likely visit
5th most likely visit

	RB	SL	PR	TRC	JAC	TBS	TC	RVP	ORC	AR	FM	BG	QS
RB	0	0.1	0.08	0.7	0.3	0.1	0.5	1.2	0.6	0.5	0.4	1.1	0.3
SL	0.1	0	0.1	0.8	0.4	0.2	0.6	1.3	0.7	0.6	0.6	1.2	0.4
PR	0.08	0.1	0	0.7	0.3	0.1	0.5	1.2	0.6	0.5	0.4	1.1	0.3
TRC	0.7	0.8	0.7	0	0.4	0.7	0.2	0.6	0.04	0.3	0.3	0.5	0.4
JAC	0.3	0.4	0.3	0.4	0	0.3	0.2	0.8	0.3	0.2	0.2	0.8	0.1
TBS	0.1	0.2	0.1	0.7	0.3	0	0.5	1.1	0.6	0.5	0.5	1	0.3
TC	0.5	0.6	0.5	0.2	0.2	0.5	0	0.8	0.2	0.03	0.03	0.7	0.3
RVP	1.2	1.3	1.2	0.6	0.8	1.1	0.8	0	0.7	0.8	0.8	0.1	0.9
ORC	0.6	0.7	0.6	0.04	0.3	0.6	0.2	0.7	0	0.2	0.2	0.6	0.3
AR	0.5	0.6	0.5	0.3	0.2	0.5	0.03	0.8	0.2	0	0.01	0.7	0.3
FM	0.4	0.6	0.4	0.3	0.2	0.5	0.04	0.8	0.2	0.01	0	0.7	0.3
BG	1.1	1.2	1.1	0.5	0.8	1	0.7	0.1	0.6	0.7	0.7	0	0.8
QS	0.3	0.4	0.3	0.4	0.1	0.3	0.3	0.9	0.3	0.3	0.3	0.8	0

Table 7.5. Physical distance matrix for Bath.

RB – Roman Baths
SL – Sally Lunns
PR – Pump Room
TRC – The Royal Crescent
JAC – Jane Austen Centre
TBS – Thermae Bath Spa
TC – The Circus
RVP – Royal Victoria Park
ORC – One Royal Crescent
AR – Assembly Rooms
FM – Fashion Museum
BG – Botanical Gardens
QS – Queen's Square

Key

closest venue
1st most likely visit
2nd most likely visit
3rd most likely visit
4th most likely visit
5th most likely visit

	RB	SL	PR	TRC	JAC	TBS	TC	RVP	ORC	AR	FM	BG	QS
RB	1.00	0.18	0.39	0.26	0.18	0.60	0.30	0.30	0.24	0.20	0.21	0.22	0.34
SL	0.18	1.00	0.14	0.16	0.12	0.20	0.10	0.09	0.09	0.16	0.12	0.00	0.18
PR	0.39	0.14	1.00	0.17	0.32	0.24	0.21	0.14	0.07	0.43	0.17	0.12	0.21
TRC	0.26	0.16	0.17	1.00	0.18	0.30	0.14	0.22	0.16	0.31	0.13	0.03	0.36
JAC	0.18	0.12	0.32	0.18	1.00	0.24	0.17	0.21	0.09	0.20	0.14	0.00	0.24
TBS	0.60	0.20	0.24	0.30	0.24	1.00	0.20	0.28	0.31	0.23	0.15	0.03	0.34
TC	0.30	0.10	0.21	0.14	0.17	0.17	1.00	0.13	0.08	0.33	0.15	0.06	0.32
RVP	0.30	0.09	0.14	0.22	0.21	0.21	0.13	1.00	0.09	0.12	0.09	0.38	0.27
ORC	0.24	0.09	0.07	0.16	0.09	0.09	0.08	0.09	1.00	0.11	0.07	0.00	0.16
AR	0.20	0.16	0.43	0.31	0.20	0.20	0.33	0.12	0.11	1.00	0.24	0.00	0.31
FM	0.21	0.12	0.17	0.13	0.14	0.14	0.15	0.09	0.07	0.24	1.00	0.00	0.15
BG	0.22	0.00	0.12	0.03	0.00	0.00	0.06	0.38	0.00	0.00	0.00	1.00	0.00
QS	0.34	0.18	0.21	0.36	0.24	0.24	0.32	0.27	0.16	0.31	0.15	0.00	1.00

Table 7.6. Conceptual distance matrix for Bath.

RB – Roman Baths
SL – Sally Lunns
PR – Pump Room
TRC – The Royal Crescent
JAC – Jane Austen Centre
TBS – Thermae Bath Spa
TC – The Circus
RVP – Royal Victoria Park
ORC – One Royal Crescent
AR – Assembly Rooms
FM – Fashion Museum
BG – Botanical Gardens
QS – Queen's Square

Key

- closest venue
- 1st most likely visit
- 2nd most likely visit
- 3rd most likely visit
- 4th most likely visit
- 5th most likely visit

A visual analysis of the tables appears to show that each location has one location that is commonly the most likely to be checked into *next* from a number of other locations within the town. This could indicate that these are the *must see* places in the town – although in 2 of 3 cases, they were not listed at the time of looking as the number one Tripadvisor attraction. Either the tourist starts there, or else they go there quite early in their visit to make sure they don't run out of time to make the visit. These 'popular' venues appear to have the biggest influence on behaviour, over both physical and conceptual proximity. Since individuals are not being tracked from the Foursquare data, it is not possible to find where people visited first - only to understand general behaviour of where visitors generally go next from the different possible starting points.

Shakespeare's Birthplace is most likely to be visited next from 5 of 8 other venues in Stratford upon Avon, regardless of physical or conceptual proximity. In 3 of the 4 other cases, the place that is most likely to be visited next is also the physically nearest (and one of these - going from the Royal Shakespeare theatre to the Swan Theatre - is also conceptually closest). This suggests that after popularity, physical proximity rather than conceptual proximity may be influencing tourists' behaviour in Stratford Upon Avon.

York Minster is the most likely to be visited next from 6 of 8 other venues in York. In the other 3 cases, the place most likely to be visited next (other than the *must see* venue) is the physically closest. One of these – Clifford's Tower to the York Castle Museum – is also the conceptually closest. This suggests that after popularity, physical proximity rather than conceptual proximity may be influencing tourists' behaviour in York.

The Roman Baths is the most likely to be visited next from 6 of 12 other venues in Bath. In this case, of the remaining 7 places only 1 place that was the most likely to be visited next – from the Botanical Gardens to Royal Victoria Park - was also the physically closest. This also happened to be the conceptually closest. Therefore, in Bath, neither physical nor conceptual proximity appeared to have a big influence on tourist behaviour.

7.4.1 VISUAL ANALYSIS OF FOURSQUARE DATA

A visual analysis of the data was conducted and can be seen in Figures 7.3 - 7.7. This visual analysis allows explanations of the observed Foursquare behaviour, which could be due to the layout of the physical neighbourhood. In the analyses, the size of the circle indicates the relative number of check-ins compared to the place with most check-ins in that town. The arrow from each location points towards the top next check-in. The number in red next to the ID of the venue indicates the number of arrows that are going to that location. Different zoom levels (figure 7.6 and 7.7) are provided to the map of Stratford upon Avon since two of the venues – Mary Arden's farm and Anne Hathaway's cottage – are a short distance out of town. However, they were included in the analysis since they have very strong links to the other Shakespeare related places and since Stratford is in any case a much smaller town than York or Bath so the physical distance is not so great as out of town places in these other two towns, at least in the case of Anne Hathaway’s cottage.

7.4.1.1 Popularity

Through this analysis, it is possible to see the ‘pull’ of popular locations such as York Minster (figure 7.3) in York and Shakespeare’s birthplace, in Stratford upon Avon (figure 7.7).

In Bath (figure 7.4) there appears to be two main ‘centres’ that people gravitate towards, these are the Roman Baths in the South of the town and the Royal Crescent in the North. The arrows seem to converge towards these two locations. Therefore, it appears as though people may start in the North of town and visit some attractions there before heading towards the centre of town and the area around the Roman Baths. This is also the area where more cafes, restaurants and shops are likely to be found. A possible explanation, but one which isn’t in scope to explore here, is that visits out of town are conducted earlier in the day so that later in the day people will be nearer to cafes, restaurants or bars for lunch, dinner or other evening activities. However, with no temporal information from the Foursquare data that was collected it is not possible to verify this.

7.4.1.2 Physical proximity

In addition, there are some common transitions that might be explained through the convenience of proximity. These include people travelling between the York Castle Museum and Clifford's tower (and vice versa) (figure 7.3), or visitors possibly starting at the Botanic Gardens in Bath, then going to the Royal Victoria Park before perhaps following a route down to the Royal Crescent that will then lead towards the main town. Similarly, a number of people heading towards the Royal Crescent from the Jane Austen Centre, or Queen's Square, appear to go via the Circus, which is easily along the route (figure 7.4).

In Stratford Upon Avon, visitors appear to commonly travel either from Hall's Croft to Nash's House and New Place, or vice versa (figure 7.7). From the map, it is apparent that there is a clear route from the popular Shakespeare's birthplace to Hall's Croft which goes via Nash's House and New Place, so for anyone travelling to all three in one day, it would make sense to go via Nash's House. However, it is also apparent from the map that the popular Shakespeare's Grave could be an alternative destination to travel to via Nash's House, or vice versa. But this doesn't seem to be the most popular choice. In fact, it seems more popular to go directly from Shakespeare's grave to his birthplace, which is counterintuitive if narrative coherence is part of decision-making.

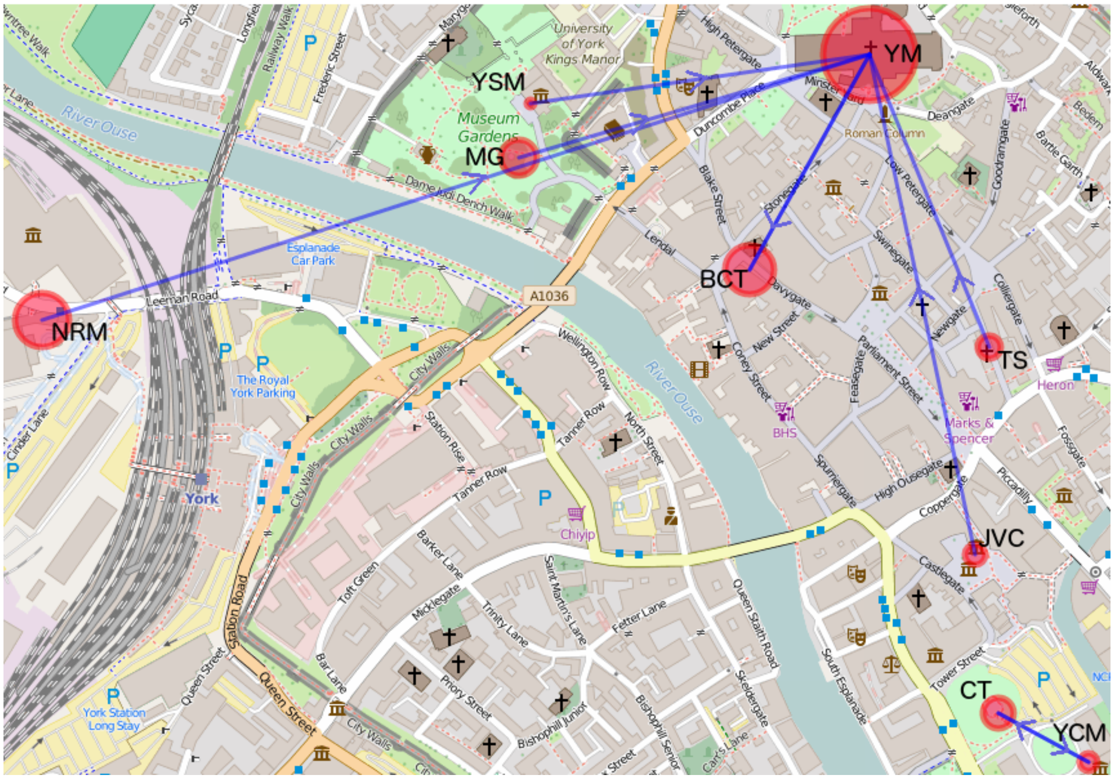

Figure 7.3. Analysis of Foursquare check-in data in York.

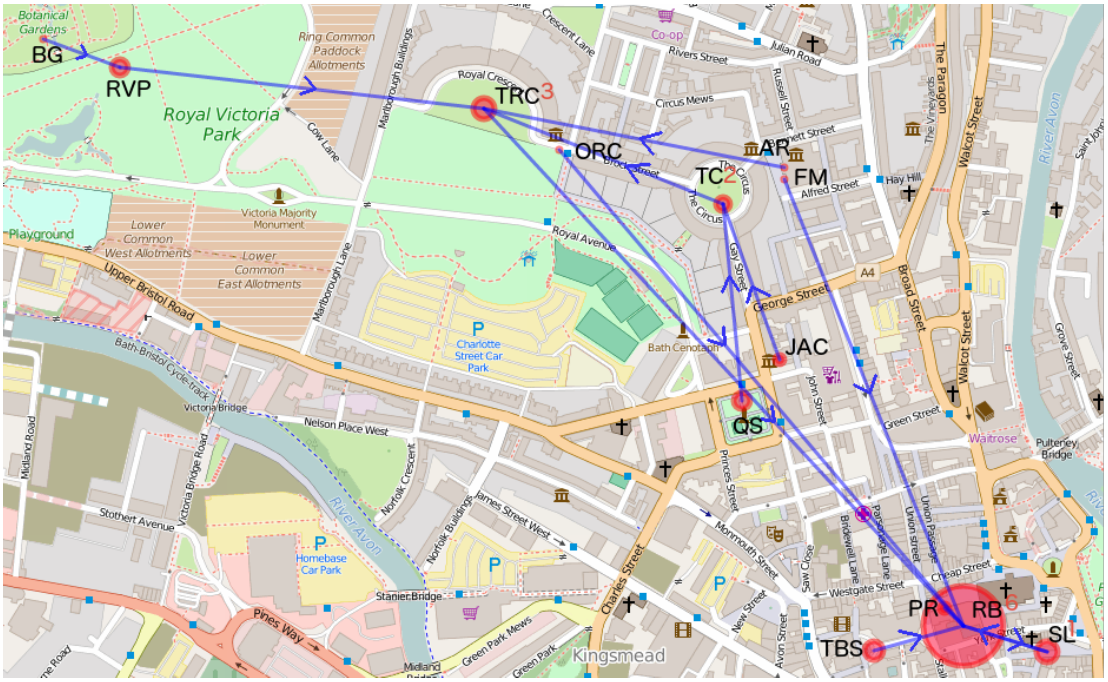

Figure 7.4. Analysis of Foursquare check-in data in Bath.

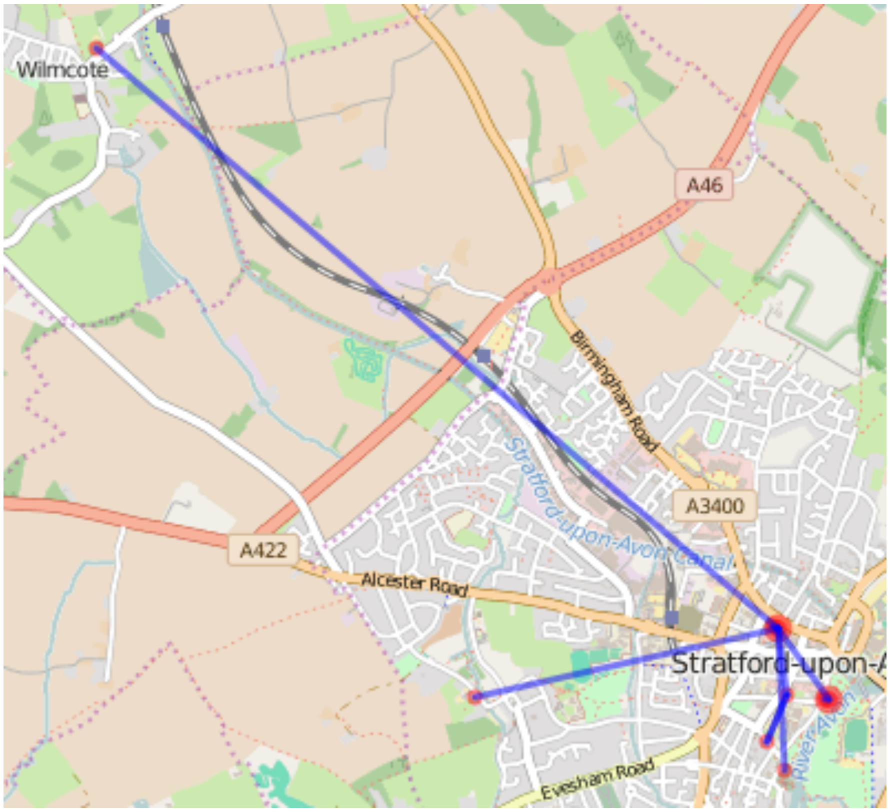

Figure 7.5. Analysis of Foursquare check-in data in Stratford upon Avon.

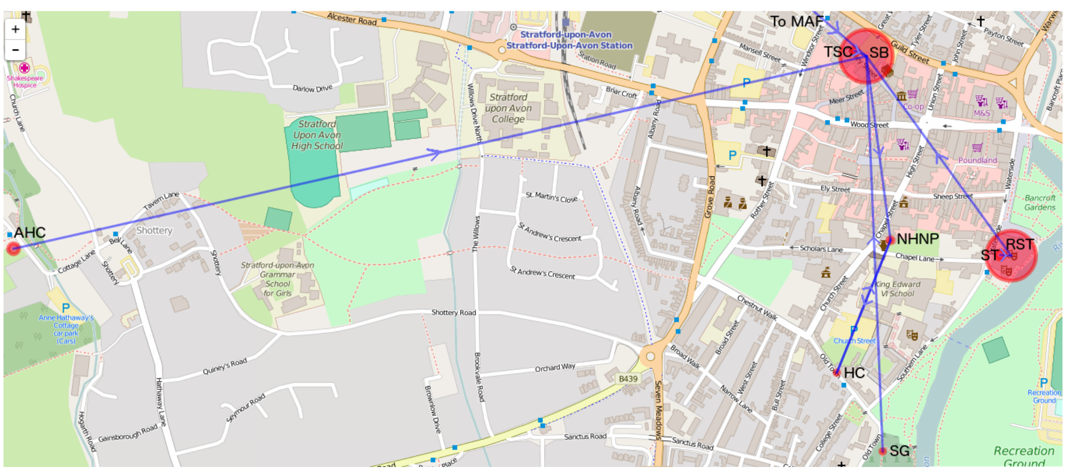

Figure 7.6 Analysis of Foursquare check-in data in Stratford upon Avon (zoomed and omitting Mary Arden's Farm)

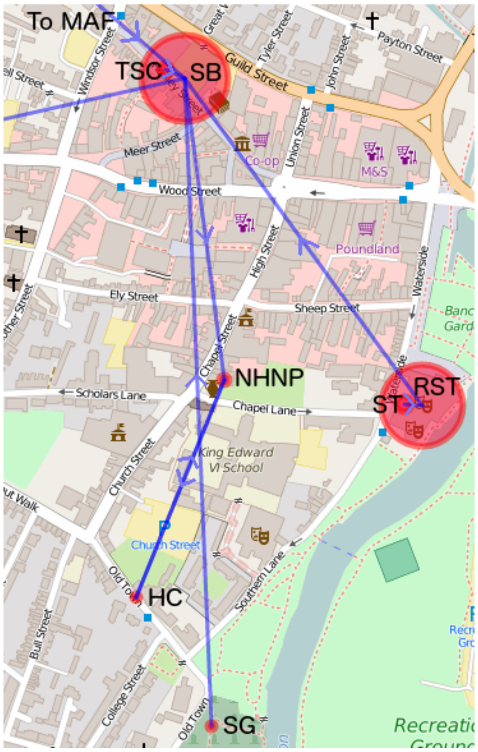

Figure 7.7 Analysis of Foursquare check-in data in Stratford upon Avon (zoomed to show detail and omitting Anne Hathaways' Cottage and Mary Arden's Farm)

7.4.2 Introducing the conceptual Neighbourhood

To understand how conceptual proximity might be influencing visitor behaviour, a further analysis counted the number of times the top ranked next check-in from each location was a) physically closest, but not conceptually closest (P not C) b) conceptually closest but not physically closest (C not P) (c) both (C and P) d) neither (not P not C). This was repeated but broadening the scope to find whether the physical or conceptually closest was within the top 3 most likely next check-ins from that location. This was done to try to mitigate to some extent the effect of popularity where the top next venue was often the most popular, regardless of physical (and possibly conceptual) proximity. This was repeated in each town. The results can be seen in figure 7.8.

SuA — TOP1

C and P	C not P
2	0
1	6
P not C	notP not C

SuA — TOP3

C and P	C not P
6	0
2	1
P not C	notP not C

York — TOP1

C and P	C not P
1	1
5	2
P not C	notP not C

York — TOP3

C and P	C not P
4	0
5	0
P not C	notP not C

Bath — TOP1

C and P	C not P
2	1
2	8
P not C	notP not C

Bath — TOP3

C and P	C not P
3	2
3	5
P not C	notP not C

Figure 7.8. Comparing the effect of physical and conceptual proximity on visitor behaviour.

The interesting figures to compare are the number of times a decision seems to be made based on Physical, but not Conceptual, proximity (P not C) compared to the other way around (C not P). In York, there is one case where visitors are more likely to check-in next to York Minster after visiting the Shambles, rather than going to Bettys Café Tearooms, which is physically closer. As discussed previously, York Minster is the most popular place in York so this could be an alternative explanation than conceptual proximity. In Bath, visitors seem more likely to visit the conceptually similar Roman Baths after they have been to One Royal Crescent, despite there being several physically closer places to go. Once again, The Roman Baths are also the most popular place in town. Also, One Royal Crescent is immediately adjacent to the popular Royal Crescent, so it is possible that visitors are not checking into both places. If this is the case, then an alternative explanation could be that visitors are actually visiting locations at that side of town before going to the Royal Crescent area and then head to the Roman Baths to start there exploration of the South side of town.

The tables show that in all cases, the P not C figure is higher. This seems to be a fairly clear indication that physical proximity, not conceptual proximity, is guiding tourist behaviour. It should also be noted that in this analysis it is not known what information tourists are using to guide their behaviour. The analysis therefore seems to show that whether or not they are being prompted to follow a conceptual route, their behaviour indicates that they are unlikely to do so.

7.4.3 DECISION TREE ANALYSIS

Decision trees were created in order to try to identify the relative importance of conceptual or physical proximity on the most likely next venue to visit.

A decision tree is a machine learning method for identifying patterns in data for the purposes of prediction. It learns by identifying which attribute values, associated with a set of sample cases, are most likely to have influenced the possible target outcomes. It outputs a set of rules for classifying cases, which are often visualised as a tree, in which branches represent different decisions. A decision tree was chosen in this case because it is possible to create decision trees from relatively low numbers of cases and because the outcome is easy to explain, since the tree will say which attributes are chosen for constructing the tree and deciding between the two or more possible target values.

Each case represented a transition from one venue (A) to another venue (B). Each transition (from venue A -> venue B) was described by the following attributes:

1. P_nearest: whether venue B was physically nearest to A compared to other venues in the town. Yes/No
2. C_nearest: whether venue B was conceptually nearest to A compared to other venues in the town. Yes/No
3. Chk_to: the number of people who had checked into venue B, to give some measure of the popularity of venue. An integer.

The **class** was either *Top* or *Top_3*. This indicated whether Venue B was either the number 1, or top_3 most likely venue to check into after visiting venue A. This had the value Yes/No.

Trees were created using the J48 decision tree algorithm in WEKA, which is an implementation of Quinlan's ID3 algorithm (Quinlan, 1986). This algorithm identifies at each point of tree generation the most informative attribute to divide between the classes. Therefore, attributes that appear higher in the tree can be said to be important for determining the class. In this case, it indicates, for each venue pair (venue A -> venue B), whether the attribute informs about whether the venue B is likely to be the top (or top_3) next venue to visit or not. An example of some rows of data for Bath are shown in table 7.7. Data was converted into .arff format for using within WEKA.

from	chk_t	p_neares t	c_neares t	top	top_
AnneHath_ShakBirth	3409	No	No	Ye	Yes
AnneHath_MaryArd	179	No	No	No	Yes
AnneHath_RoyShakT he	3204	No	No	No	Yes

Table 7.7. Sample of data used for generating decision trees.

Trees were generated firstly for TOP and then for TOP_3 for each town in turn. It did not make sense to merge the datasets since something like the check-in numbers may be comparative between venues in the same town, but not when comparing one town to the other, unless total visitor numbers for each town is known thus making it possible to normalise the check-in values. For a similar reason, it was decided to use a binary value to indicate whether venue B was physically or conceptually closest to venue A, or not, rather than to use the absolute value, as it doesn't really matter that once place is so many meters or miles further than the other, what is important to know is whether there was somewhere that was closer that they could choose to visit instead.

The list of rules that were discovered through the decision trees for each town is listed below (the full WEKA outputs can be found in Appendix F, along with the total check-in stats for each location and also the number of users who checked into those locations).

7.4.3.1 Top trees

Bath - top

This pruned tree identified no attributes for determining whether something would have the value 'Yes' for being the Top 'most likely' next venue. A total of 142 instances (each a transition between venues in Bath) can be classified correctly by this, whereas 14 will be classified incorrectly.

: no (156.0/13.0)

Correctly Classified Instances	142	91.0256 %
Incorrectly Classified Instances	14	8.9744 %

Stratford upon Avon - top

This pruned tree identified that the most likely ‘top’ next check-in would be to a place that had been checked into more than 3204 times. This indicates popularity of the venue is an important factor.

chk_to <= 3204: No (64.0/4.0)

chk_to > 3204: Yes (8.0/3.0)

Correctly Classified Instances	62	86.1111 %
Incorrectly Classified Instances	10	13.8889 %

York - top

Similar to Stratford upon Avon, this pruned tree identified that the most likely ‘top’ next check-in would be to a place that had been checked into more than 3606 times. This indicates popularity of the venue is an important factor.

chk_to <= 3606: No (64.0/3.0)

chk_to > 3606: Yes (8.0/2.0)

Correctly Classified Instances	67	93.0556 %
Incorrectly Classified Instances	5	6.9444 %

7.4.3.2 Top 3 trees

Bath – top 3

Again, popularity of venue, as indicated by check-in totals, appears to be a deciding factor for predicting whether or not the venue will be in the top_3 for a tourist to visit next.

chk_to <= 1977: no (132.0/19.0)

chk_to > 1977: yes (24.0/6.0)

Correctly Classified Instances	131	83.9744 %
Incorrectly Classified Instances	25	16.0256 %

Stratford upon Avon – top 3

In this case, the rules for predicting whether or not the venue will be in the top_3 for a tourist to visit next is more complex.

c_nearest = No

| chk_to <= 671: No (45.0/4.0)

| chk_to > 671: Yes (13.0/4.0)

c_nearest = Yes

| p_nearest = No

| | chk_to <= 567: No (6.0/2.0)

| | chk_to > 567: Yes (2.0)

| p_nearest = Yes: Yes (6.0)

Correctly Classified Instances	58	80.5556 %
Incorrectly Classified Instances	14	19.4444 %

A summary of the key rules are as follows:

1. If the venue *is not* conceptually nearest, but is more popular, then it will be in the top_3
2. If the venue *is* conceptually nearest and it *is* physically nearest, then it will be in the top_3
3. If the venue *is* conceptually nearest and it *is not* physically nearest but it is more popular, then it will be in the top_3.
4. Otherwise, the venue will not be in the top_3.

Taken as a whole, these rules suggest that visitors are mainly choosing where to go next based on popularity, as indicated by the number of check ins. A conceptually similar place might be chosen over a physically *closer* location, if the further location is also popular. Otherwise, when choosing between two places that are about the same distance from the current location, the conceptual similarity to the current location might play a deciding factor in their choice. Therefore, popularity and physical proximity play a greater role than conceptual similarity in influencing visitors in choosing their next destination.

York – top 3

The rules derived from the data for York for predicting whether or not the venue will be in the top_3 for a tourist to visit next also indicate that both popularity and physical proximity is important in determining visitor behaviour.

```
chk_to <= 3606
|   c_nearest = No: No (53.0/11.0)
|   c_nearest = Yes
|   |   p_nearest = No
|   |   |   chk_to <= 1483: No (2.0)
|   |   |   chk_to > 1483: Yes (6.0/1.0)
|   |   p_nearest = Yes: Yes (3.0)
chk_to > 3606: Yes (8.0)
```

Correctly Classified Instances	57	79.1667 %
Incorrectly Classified Instances	15	20.8333 %

A summary of the key rules are as follows:

1. If the venue receives more than 3606 check-ins, then it will be in the top_3
2. If the venue receives less than 3606 check-ins and is both the physically and conceptually nearest, then it will be in the top_3
3. If the venue receives less than 3606 check-ins and is the conceptually nearest but *not* the physically nearest, then it will need more than 1483 check-ins to be in the top_3

Taken as a whole, the decision tree data suggests that popularity, followed by physical proximity, followed by conceptual proximity are useful for predicting tourist next venue check-ins in Foursquare. In fact, conceptual proximity only seems important when it is combined with physical proximity.

7.5 Conclusions

This study was designed to provide insight into the question (SQ4) '*What is the relative importance of physical and conceptual proximity 'in the wild' for tourists navigating multiple points of interest?*'

Foursquare data can be used to discover patterns of tourist behaviour. An analysis across three U.K. towns has revealed that visitors to these locations are likely to be using a combination of popularity of a tourist attraction and physical proximity to guide their navigation. Conceptual proximity does not appear to be influencing tourist behaviour to any extent in these towns. It is interesting to note that an effect of physical distance can be seen in the data, despite the obvious pull from the 'most popular' places.

As previously identified, the majority of mobile apps to support tourists are aimed at directing tourists towards places that are conceptually related to the place they are at, or have been, or which reflect some specified interests (e.g. Noguera et al, 2012, or Cheverst, 2000). This does not appear to reflect how tourists want to be guided in a city. This was firstly identified by previous research of Mitchell and Chuah (2013) and Tintarev et al. (2010). It is also reflected in prior work analysing Foursquare data such as Noulas et al. (2012) who use proximity to predict where people will check into next. This effect was confirmed during the sculpture garden and virtual tour studies. In this instance, it has also been confirmed through the analysis of Foursquare data. What has been added in this case is to find a way to measure conceptual proximity and to discover to what extent this seems to influence visitor behaviour.

8 DISCUSSION

This thesis has set out to explore how people engage with narratives firstly online, when objects can be organised to reflect a narrative and secondly in a physical space where they cannot. These two cases are now discussed.

8.1 Narratives across Virtual Objects

The investigation of narratives across virtual objects was explored through the scenario of undertaking a web-based historical inquiry from a set of web-based resources. The key finding of this thesis was that *curation* processes are important in creating narrative across objects, including online resources. Of particular importance is the ability to move objects to reflect their narrative relationships. The approach to answering this question was through the development of a model of curatorial inquiry that was validated against existing museum practice and against inquiry-based approaches to teaching history.

The first finding was that there are significant commonalities between curatorial practice in a museum and the process of a historical inquiry. In the museum, the curator answers an overarching question through the process of selecting, interpreting and organizing objects. The output is some form of narrative. One example is a physical exhibition in which objects are more important than supporting narrative text. Another is the museum catalogue where the same narrative organization may be used, but with more importance given to writing the stories of the artists and relationships between objects. In a historical inquiry, a student answers an inquiry question by selecting and interpreting primary and secondary sources. Overall, whilst the link between curation and learning can be found to be explored through blog posts and other Internet articles, there is little to be found in formal academic literature. One study that was found to be of relevance was that of Leat and Nichol (2000), who observed that a curatorial approach to grouping, organizing and reorganizing content related to the inquiry was a natural strategy adopted by learners. This curation step, however, does not appear as a part of existing models of historical inquiry, such as SCIM-C (Hicks et al., 2004) which focuses on critiquing of primary and secondary sources or GATHER, which is very similar to models to support scientific inquiry (and in which content curation is not a key activity). However, this process of organising and reorganising content to reflect a story is found in existing museum curatorial practice.

Therefore, the main contribution of the model of curatorial inquiry is the inclusion of this curation step. This effectively moves historical inquiry from fixed/virtual into moveable/virtual space.

It naturally follows that since curation is not considered as part of a model of historical inquiry, that online tools to support this type of inquiry would not support curation activities. This finding was confirmed by reviewing online approaches to scaffold inquiry, such as HSI (Swan and Hofer, 2005). However, by moving into the moveable/virtual space the suggestion was made that existing content curation tools might be useful for supporting historical inquiry. The main finding was that at the time of assessing the available tools, the full range of required functionalities were not present in any one tool. The QrAte tool for curatorial inquiry was therefore developed. The strength of this tool is that it supports all parts of an online historical inquiry, including facility to interpret both individual and groups of content, to describe relations between groups of content and to organise and reorganise content as needed. The tool was not evaluated with users and therefore the validity of the tool can be judged only against the criteria of supporting more historical inquiry processes than other tools.

A further proposal was that the output of an inquiry might act as input for a future inquiry, in which a student can actively *recurate* the output to reflect their own understanding and that this approach might help learners undertaking an inquiry. However, this approach was not evaluated as part of the thesis and there is no real evidence to support the idea. Future work could focus on comparing inquiry from different sources, including the recuration of existing inquiry outputs.

8.2 Narratives across Physical Objects

In the physical space, when object order is fixed, there are two possibilities. Either objects are already organized to reflect a narrative presentation - such as a curated museum exhibition – or else they are encountered in a non-narrative order, such as in the sculpture garden or city tour examples. This thesis has focused on the latter case, where the objects do not reflect a narrative and where they cannot be reorganized to do so. The key findings of this thesis were that cultural visitors want to understand narrative connections not just between closely related museum exhibits, but also the more loosely connected objects in museum grounds and the objects and points of interest that can be found across cities. However, visitors prefer to select paths based on physical proximity rather than conceptual coherence. Visitors may ignore both physical and conceptual proximity in order to visit popular places.

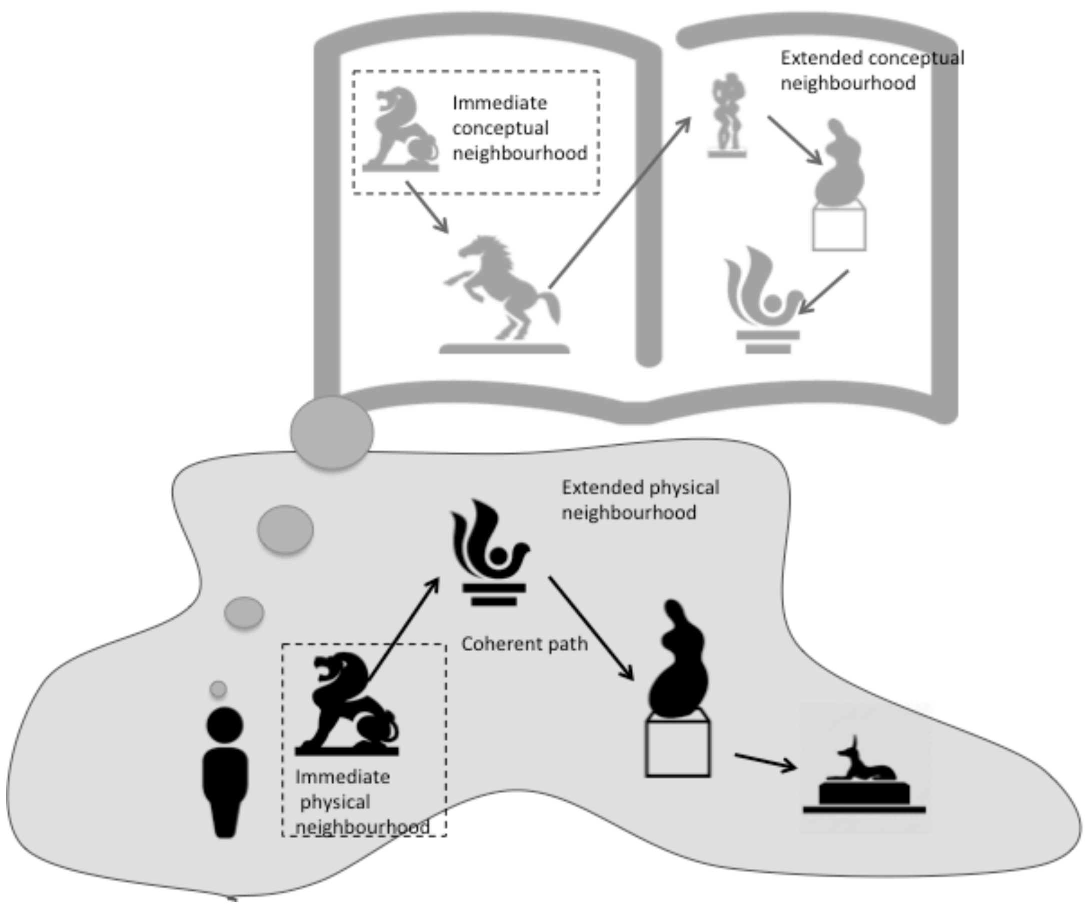

Figure 8.1. The immediate and extended neighbourhood of an object in physical and conceptual space, with a coherent path picked out between them.

The approach to answering these questions was through the development of a model of physical and conceptual space that was then used to support the design of three distinct studies. The model (first shown in Chapter 5) is produced again in figure 8.1.

The first study was conducted in a sculpture garden of the Irish Museum of Modern Art. Participants could scan QR codes to access stories on their device that explained how the object in front of them was linked to other stories, some of which were related to other objects in the same museum grounds. Participants were not actively recruited and many people who took part did so either because they saw an advert on social media and then turned up and started scanning, or else they saw the QR codes when they were there and scanned out of curiosity.

The findings of this study seemed to support the idea that some visitors would be firstly curious enough to scan QR codes and secondly, that they would continue to access at least some of the provided story links, but that this would not influence their pathway through the grounds. This was demonstrated by tracing the sequence of QR codes scans and finding, for example, that the visitor had walked down the main museum driveway scanning each item in turn, despite the information on the device showing different conceptual connections. In other words, visitors preferred to follow a physical rather than a narratively coherent route amongst the points of interest. This confirms the findings of Stravroulaki and Peponis (2003), that visitors use a mixture of physical proximity and line of sight to guide their navigation amongst museum exhibits.

This study had a number of limitations that could affect both the validity and the generalisability of the results, which are now discussed. As mentioned previously, this study was conducted as part of a larger project and there was a necessity to align with the requirements of the museum partners. Firstly, it was not possible to elicit direct feedback from the visitors, as the goal was to find to what extent the presence of QR codes would prompt spontaneous engagement. This means it is not known to what extent visitors would have wanted to follow the conceptual route. It is only possible to evaluate this from their behaviour. As mentioned, recreating routes from QR codes tended to show that visitors followed a coherent physical path and ignored conceptual links. However, the device did not show where related items could be found but only prompted visitors to ‘look around’ or ‘head up the avenue’. There was no map. So even if visitors were interested in finding the items, they would have no clear idea where to go, unless they were already familiar with the grounds, and so might default to the easier strategy of exploring nearby for something else to see. Therefore it is hard to draw any firm conclusion from this result. Similarly, only 18 out of 47 unique participants scanned more than one code. This is a relatively low number from which to draw conclusions. A further limitation could be in terms of the sample. Popular museums such as IMMA generally attract multinational visitors. However, such visitors may not have Internet connectivity and there was no Wi-Fi available in the grounds. Therefore, a number of potentially interested visitors could have been prevented from participating. At the same time, local visitors may have visited before and this could affect their level of interest. There was no way of finding this information from the participants.

The mobile content to support the visit was designed using the model of physical and conceptual proximity and was validated through the museum professionals. The input from the museum professionals was used to validate both the approach – for providing physical and conceptual navigation as part of the device content – and the story content, which was generated using ideas of conceptual proximity based on narrative principles of setting and theme. Since visitors were not recruited and could be anyone attending the museum on the days where the QR codes were put in place, this indicates that the museum professional felt the overall experience was of sufficient quality not to reflect badly upon the museum.

For conceptual navigation, the site content was designed to provide local coherence through the stories, which were accessed by a sequence of story links. The physical navigation was facilitated through some additional information on the device which made some reference, where it was deemed necessary, to the physical neighbourhood, e.g. ‘now head up the avenue! You should be able to see more artworks and QR codes along the way.’ This is consistent with the proposal of Tzortzi (2011) that it is important to provide areas of local coherence in a museum, as a priority over providing routes between regions.

In the second study, participants were invited to participate in a virtual tour of Paris and to scan QR codes to access device content. This was based upon the sculpture garden study but in a more controlled setting. A key focus of this study was in eliciting information via questionnaire as a way to understand visitor preferences for understanding narrative relationships between places of interest in a city. The findings of this study again appear to support Stravroulaki and Peponis (2003) that visitors generally choose physically coherent routes. In addition, there were fairly clear indications in the responses of participants to the questionnaire that they wanted to find out the stories that linked the places that they were visiting. A tentative finding was that more coherent narrative experiences led to better recall of the overall experience, as evidenced through the questions that the participants answered at the end of the study. This is consistent with earlier findings by Wolff et al., (2004) that narrative organisation improves recall. In this case, the narrative coherence was either provided through the organisation of objects in the physical space, as in Condition 1 of the study where the organisation reflected individual narrative groupings or else through the information provided on the device, where the narrative order in physical space was disrupted but the device showed the groupings of narratively similar items whenever an object in that group was being visited. In the latter case, the findings could also be due in some part to seeing the groupings far more frequently, as the participants would have seen each group three times, once for each time they visited a place in the group. However, this cannot completely explain the trend since many of the questions related to their route through the physical space, or to information that appeared only on the wall next to an item.

There are some further potential limitations to the study. Given the small number of participants in each condition it was possible to do only a qualitative analysis of the data, from which it is hard to generalize. Also, because the tour guide in Condition 4 of the study was not adaptive, when a participant followed a suggested route, it was possible that they came across an object that was at the end of a trail. This would not give them enough information to allow them to see the coherent grouping, even if they did follow the directions. However, since the majority of participants seemed to either follow a linear or completely random route, this would not have affected the results too much. In the one case where a participant did try to follow the instructions it was possible to do a detailed analysis to see at which points they would have been disrupted and which may have affected their recall. Follow up work could re-run the study both with more participants and with an adaptive tour guide. This would ensure that in the condition where participants are being guided towards visiting objects in a conceptually coherent order they would always be guided to all items in the group and not risk finding an item in the middle, or end, of a trail.

To summarise, collectively these two studies using the QR codes and information presented on mobile devices appear to confirm a preference for physical proximity as found by tracking the movements of visitors both in the sculpture garden (from the QR codes) and on the virtual tour (by following the route around the sites). It was difficult to assess the extent to which visitors to the sculpture garden engaged with conceptual information provided on the device. On the virtual tour, most participants who were given conceptual information chose to ignore it. However, a large number of participants in their written answers to the questionnaire did confirm that they were interested in understanding the connections between the places, and would like more information from the device on the nature of the relationship.

In the final study, the model of physical and conceptual space was used to interpret results obtained by analysing Foursquare data. The key finding of this study was that tourist patterns reveal preferences for navigation by popularity of venue and then by physical proximity. Conceptual proximity does not appear from this data to be influencing visitor movements. This finding that people visit places that are popular supports the findings of Tintarev et al (2010). They discovered that people would visit recommended sites when they were all popular, but were less inclined to follow recommendations that had been personalised for the visitor.

There are possible limitations to this study, which are now discussed. Firstly, the Foursquare check-in approach shows a particular view on the data. As has been shown, visitors tend to check-in more to certain types of venue, such as those where they might meet friends (Frith, 2014; Lindqvist et al., 2011) or those they deem interesting (Patil et al., 2012). This could affect the validity of the results, for example where venues show a low number of check ins rather than indicating that they are less popular it could indicate that less people bother to check in. This would affect interpretation of the findings with respect to both venue popularity and also would affect the ‘next venue’ data analysis if people may have visited a venue but not checked in there. However, whilst it is not possible to find from the Foursquare data whether someone has failed to check into a venue, it is possible to compare the popularity of venues as given by Foursquare with the relative popularity of the same venues of somewhere like Tripadvisor, as a way to independently verify the data. For example, it is possible to verify from the York Tripadvisor site that York Minster (6030 check ins on Foursquare, number 2 of 180 things to do in York at time of access) is more popular then The Yorkshire Museum (530 check ins on Foursquare, number 51 of 180 things to do in York). A further issue can be that some places are listed separately for check in on Foursquare but occupy the same place. In the case of the Regency Tea Room, this is in fact part of the Jane Austen Centre. A visitor to both may easily check into just one of them. However, the strength of the Foursquare approach is in the volume of data, from which generic patterns can be extracted.

Secondly, the conceptual proximity of places was calculated from a vector created by extracting key entities from the related Wikipedia page using AlchemyAPI. There are ways in which the vector created from entities could be improved, for example currently names are ‘split’ so ‘Anne’ and ‘Hathaway’ appear as two different entities. This could affect the accuracy of results by finding similarity between two unrelated Anne’s, or two unrelated Hathaway's. Since in the three towns studies so far, there does not appear to be any significant impact of conceptual similarity, even where this may have been calculated using too inclusive a measure of similarity, it did not seem worthwhile on this occasion to try to make the measurement more accurate. However, as mentioned previously, the entity extraction found only people, places and themes. The temporal element of the *setting* was missing. To some extent this did not impact the similarity, for example where the entities themselves designate a time period, for example people such as 'Shakespeare' have a life span. Overall, whilst a more accurate similarity could perhaps have been measured by taking into account some of the time periods it is not clear that this would have had any significant impact on the results. Especially when considering the analysis reveals, for example, that visitors are quite likely to visit firstly Shakespeare's grave before travelling to his birthplace (starting with a place at the far end of town and working in, perhaps).

Finally, whilst the use of Foursquare data was intended to provide support for findings from the more focused studies, there is also the possibility that the choice of towns for Foursquare analysis is not representative of tourist behaviour in larger cities, in other countries, or that were configured very differently. For future work, it would be interesting to replicate the analysis in these different situations. However this may provide additional complexity, for example in understanding how different transport choices between places might affect tourist behaviour, such as if two places are easy to travel between by tube compared to places that are physically closer but not quite walking distance but where at least one tube interchange was required.

8.3 Future Work

This thesis has sought to understand how different types of narrative can support navigating through physical and conceptual space amongst a set of objects and the extent to which different prompts might help or hinder this process. This has been explored through a series of research questions, RQ1-4, which help to inform the answer to the main question of the thesis. The following explores how the findings of the thesis, as described thus far, might be put into practice in the development of tools to support tourists.

The overall suggestion that emerges from this thesis is to develop tourist apps that are similar to the 'Serendipitous City Guide' of Hornecker et al. (2011). Such a guide would be designed to support un-planned tourist activities, to facilitate visitors to choose popular, nearby places over conceptually related ones but at the same time, to take into account the preference of visitors to still understand the relationships between places that they visit. Development of such a tour guide can be supported through the model of physical and conceptual space, by building conceptual stories that link places and which can be shown in the locally coherent context of each individual point of interest. This thesis further proposes that narrative principles of setting and theme can be used for grouping and organising content in the conceptual space to provide a conceptual navigation order amongst objects.

Figure 8.2. Showing four different ways to visualise relationships between POIs using notions of physical and conceptual proximity.

This idea is illustrated in figure 8.2, which shows four different possible ways of presenting information about a place and its physical or conceptual relationships to other objects that share a neighbourhood. The first two cases show fairly standard ways of presenting information about physical or conceptual relationships, firstly a physical map and secondly a coherent conceptual story. The other cases explore how a different kind of visualisation may provide alternative ways to view how POIs are related which combines information about both physical and conceptual proximity. In one case, the length of an arrow from the current location to other places in the neighbourhood indicates the physical distance whilst the thickness indicates how closely they are conceptually related. In the other case, the length of arrow indicates the conceptual distance from the current POI to other places (and thickness indicates physical distance).

Such a guide would overcome the concerns highlighted by Mitchell and Chuah (2013), Tintarev et al. 2010 and Sharples et al. (2013) that whether in a museum or visiting a city, tourists do not want to be shepherded towards conceptually related places. Such a guide would facilitate 'trail editing', which is the narrative building process identified by Peterson and Levene (2003) in which museum visitors undertake to mentally reorder objects encountered in a different physical configuration within the museum. In this case, the process can also take place outside the museum and across the city, across loosely connected objects and places of interest. Visitors are able to undertake the visit in the fixed/physical space in the order they like, following a navigation strategy of their own choice. Information is provided through a hand-held device to assist with trail editing. The emphasis in this case is on trail editing in situations where the narrative is already quite disrupted, and where narrative connections between many objects encountered may be quite weak, or even non-existent and where support is more likely needed than in the museum, where objects – although in a fixed order - are already organised to reflect narrative.

The proposed tour guide, which will be given the name *QraTour*, is now explored through a possible scenario.

8.3.1 QRATOUR

Carol is a tourist visiting a city for the first time. Carol has looked at some guidebooks and websites before visiting and has a rough idea of the places that she wants to visit, but has not planned an exact route, timing or itinerary. She has found a hotel near the centre of the city and in the morning of her full day of sightseeing, she picks up a map from the front desk. From this map, she can see that a popular cathedral is just a short walk away. She decides to start her day at this cathedral. On the way there from the hotel, she passes an interesting looking building that doesn't appear on her hotel map and which doesn't have any identifying information apart from a stone carved with the initials KGS. She has downloaded QraTour and now gets out her mobile device and opens it up. It uses GPS to pinpoint her location and show her nearby places, with a small icon. She sees that the first item in the list is the place she is curious about and there is some information provided about it, telling her that it is an old School building, for King George School that is now in private ownership. Before it passed into private ownership it was used as the head office for a local hat-making firm. There is a button at the bottom that she can touch to see the conceptual relations between the school and other places in the city. She presses this and sees immediately a close conceptual relationship between the building and the cathedral, indicated by two icons close together. The device also still indicates that the two places are physically nearby. She clicks on the link and an explanation pops up to say that the school children used to use the cathedral for their religious events and that a former student of the school became the Dean of the Cathedral in 1902. She explores more conceptual links and finds that whilst nor particularly famous for it, the town also has a rich history in hat making, with several historic locations in town related to this trade. Since Carol knows that the Cathedral is both physically and conceptually close to her current location, she decides that it still makes sense to go there. She uses the QraTour app to navigate her to the cathedral, a function that is available by selecting the Cathedral from her current screen. From the Cathedral, Carol can use QraTour to see the conceptual and physical distance back to the former school, as well as to additional places related to the Cathedral. Carol uses this information to navigate around the town, mainly choosing places that are close by and which are either conceptually close to her current location, or places she had previously identified as being popular and worth a visit. In addition, when Carol recognises some places appearing as being physically close to her current location and that were also related to the hat-making industry, she decides to visit. Through literature provided at these places she learns a lot about the hat-trade, which was not an anticipated outcome of her visit.

8.4 Summary

When objects can be curated and organised to tell stories, this supports both the author and the reader of the narrative to understand the narrative connections in a more coherent way. This is reflected in modern museum exhibition design. When objects cannot be moved – such as when visiting cultural sites in a city - this can disrupt the coherent experience of points of interest, which in turn can affect a visitor's experience by reducing their ability to understand the connections between the places that they visit. This thesis finds that people do express interest in understanding the relations and stories that link cultural sites. However, it is the findings of this thesis that people would prefer to have a disrupted experience than walk out of their way, despite the potential benefits for them in making the experience more conceptually coherent. This chapter concludes by proposing a QraTour application that supports tourists in selecting their own tourist routes, whether following an existing tour route from a book, or choosing places on the spur of the moment based on how close, or how popular, they are. The QraTour application would reveal the connectedness of places within the city, so that visitors can either use this information to guide their decisions, or simply use it to help them understand the narrative links between places and support them in telling their own stories about their city visit. Some possible ways to combine physical and conceptual information into a single visualisation are also proposed.

9 CONCLUSIONS

This thesis set out to answer the question (MQ1):

> *How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?*

Four studies have been introduced, each of which provides some insight towards answering this question, through the posing and answering of a number of sub questions. The framework for this research can be found in table 9.1, which is reproduced from the introduction to this thesis. The four sub questions within this framework will now be revisited in light of the findings of the four studies, which will provide the evidence used towards answering the main research question of this thesis.

<table>
<tr><td>Main research question (MQ1)</td><td colspan="3">How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?</td></tr>
<tr><td colspan="4">Four sub questions have been identified for answering the main research question. Each question is aligned to a study that can be found in a later chapter of the thesis.</td></tr>
<tr><th>Question no.</th><th>Question</th><th>Chapter</th><th>Description</th></tr>
<tr><td>Sub question 1 (SQ1)</td><td>How can methods from inquiry and from the curatorial practices of museums inform narrative construction?</td><td>Chapter 4 – QrAte tool for historical inquiry</td><td>Using a combination of literature review, examples from museum practice and drawing upon theories of inquiry-based learning, this chapter develops a model of curatorial inquiry to support the undertaking of an online historical inquiry in which primary and secondary source materials are analysed and organized to create a new historical account. This model aims to understand how narratives</td></tr>
</table>

			may be constructed across diverse resources through a process of curation.
Chapter 4 lays the foundation for and motivates the remainder of the thesis, which focus on narratives that occur in a physical space, where the objects are fixed and therefore *cannot* be curated. The questions associated with these further chapters are now described.			
Sub question 2 (SQ2)	How can construction of narratives be supported in a physical space when objects cannot be organized to reflect the underlying narrative?	Chapter 5 - IMMA sculpture garden	This chapter introduces a model that distinguishes the *physical narrative* that is experienced when visiting multiple points of interest in a physical space from a *conceptual narrative* that provides a coherently ordered story across the same objects. This model is used to support the design of three subsequent studies that explore how narratives are experienced by a 'reader' across a physical space of discrete objects, when the objects cannot be moved. This chapter describes the first of these studies, investigating how people navigate amongst artworks in the grounds of a museum and how they engage with stories about the objects on a mobile device.
The IMMA study reported on in Chapter 5 raises additional questions about how navigation decisions are made and how they can be supported. The following studies were conducted in parallel to investigate these issues of support prompts and to investigate 'in the wild' behaviour. Each had strengths and weaknesses in what they could show, which will be discussed in the methodology chapter (chapter 3).			
Sub question 3 (SQ3)	What effect do different types of prompt have on decisions made about navigating multiple points of interest?	Chapter 6 – Virtual Tourist Trail	This chapter introduces a controlled study aimed to elicit detailed feedback from a small number of participants as to what motivates their navigational decisions when they are acting as tourists and visiting multiple points of interest and how different types of prompt may or may not influence their choice.
Sub question	What is the	Chapter 7 –	This chapter analyses data from

4 (SQ4)	relative importance of physical and conceptual proximity 'in the wild' for tourists navigating multiple points of interest?	Foursquare Analysis	Foursquare social media check-ins to identify common patterns of behaviour and to identify whether these can be related to physical or conceptual proximity, or to something else.

Table 9.1. Revisiting the research framework

Sub question 1 (SQ1): How can methods from inquiry and from the curatorial practices of museums inform narrative construction?

The starting point for understanding how stories are told and experienced across collections of objects has been to reflect on curation practices in the museum. Here, curators group and organise objects so that as a visitor follows a natural path through the museum they will experience the objects in an order that prompts the visitor's own understanding of the narrative connections that they themselves found whilst researching and creating the exhibition. But visitors bring their own knowledge to the museum, and they do not always follow the curator's intended path, nor are completely linear paths afforded by the layout of each museum. Therefore, whilst the curator's organisation of objects helps the visitor by providing a coherent view across the artefacts on display, the visitor will find their own unique story, incorporating aspects of the objects they engaged with, the stories they read and their own background knowledge. This thesis has discovered how modern museums are using this knowledge of visitors' active narrative construction across their objects to find new ways to facilitate this type of constructivist museum experience.

A key question of this thesis has been to ask what can be learned from this museum practice that can inform alternative situations where people are actively creating narratives across objects. When building narratives across sets of objects, a curatorial approach to moving both virtual and physical objects to reflect relationships between them is of benefit to both authors and readers of the resulting narrative. Curation is undertaken with respect to an overarching question. Authors use the ability to move objects as a way to help to select and focus on relevant objects and to explore the relationships between them and to produce a coherent narrative output that answers the question of the inquiry. This in turn helps the reader of this narrative output to align the order in which they encounter items - in either virtual or physical space - with the conceptual story order, so that they experience the narrative that the author intended. For the reader to then act as an author of their own narrative, they too benefit from being able to move objects. This can be facilitated in an online space by allowing recuration of the content from the presented story order to a new story order. This approach could support a web-based historical inquiry, by allowing the curation of an initial set of primary and secondary sources that a student can then recurate to reflect their own understanding. This recuration may involve changing the order, selecting resources to include or ignore, or bringing in new resources. Overall, the findings of this thesis have been that the processes that support the creation of narratives across mixed media online resources are equivalent to those processes that support the curation of museum exhibitions, which in turn is demonstrably similar to an inquiry-based approach.

These findings led to the creation of the model of curatorial inquiry to support answering historical inquiry questions across diverse online content. This model supports learners in interpreting across the content by prompting them to identify key narrative events, including time periods, places, people and other themes and then to physically arrange content and events to reflect their understanding of the relationships between them. This curation step extends previous models of historical inquiry. This moves historical inquiry from being a task of recreating narratives from across a set of static resources to one in which the content itself can be actively curated. However, by analysing existing tools to support historical inquiry it was found that they do not facilitate curation of content. Whilst a number of tools did exist for social content curation at the time of assessment, none of them adequately addressed all stages of undertaking a curation/inquiry task, such as the ability to annotate individual content with the learners own interpretation of the content with respect to the goal of the inquiry as well as to make groupings of content and interpret these as a whole. These activities are important for the inquiry process. In most cases, content will include redundant or misleading information. Being able to make notes and annotate across content helps the learner to reflect on the parts of each piece of content that they find relevant to their own inquiry and, perhaps more crucially, to communicate this to future readers of their narrative. Therefore, a tool called QrAte was developed that supported all stages of a curatorial inquiry. This demonstrated how a social curation tool might be developed that genuinely supports processes of curation as the term is used in the museum setting. The overall conclusion from the development of the model of curatorial inquiry and the related QrAte tool is that narrative building across objects, in the online space, is facilitated by changing the activity from being one of experiencing a set of static resources - whether or not they are already narrative organized – to one of actively organizing resources to reflect their relationships.

To summarise, a major finding of this thesis was that the ability to organize objects to reflect a narrative helps the author in understanding the relationships between them and in conveying a story to an audience. This is reflected in the process of curation undertaken by museum professionals who tell stories through the careful placement of museum objects in a physical space. Whilst the visitors are not able to move the objects themselves, the curation task is intended to display them in a way that makes the narrative meaning more obvious. Therefore, curation helps both the constructor and the reader of the narrative.

Sub question 2 (SQ2): How can construction of narratives be supported in a physical space when objects cannot be organized to reflect the underlying narrative?

In the physical space, museum professionals curate exhibitions through the physical organisation of objects. However, the public must then experience the narrative in a static way. As mentioned previously, their understanding is helped through the aligning of the narrative ordering of objects with the order in which they are experienced in the physical space. This thesis has focused next on exploring scenarios where it is *not* possible to align physical and conceptual narratives, specifically outdoor cultural visits either in the grounds of a museum across a set of loosely related artworks or cultural city visits. In these scenarios, the objects in question may have narrative connections, but quite often the overall narrative is less coherent than in a museum. In the case of the sculpture garden of the museum, there are a number of works by the same artist, and/or of the same material, and/or depicting the same theme. There are tours provided by the museum that direct visitors on routes that take in only one type of artwork, for example a 'Bronze' trail to take in only artworks made from bronze. However, for visitors who want to just explore the grounds in their own way there is only a very limited amount of information provided for each piece and there is nothing to explain where related items are, or how they may be related. This situation is similar when visiting a city with the intention to see a number of places in a short time. If a visitor chooses to be fairly spontaneous and not to follow a tour, they may find that they find little information on certain places - not everywhere will be open to the public, or open at that time of day, or have information provided about it. To find out how places in the city are related it is necessary to start researching from either online resources or guidebooks, digging through the various narratives provided.

Identification of this problem led to the development and testing of a model that distinguishes the narrative that visitors experience in a conceptual space of stories that link objects from the narrative experienced in the physical space as they walk between one point of interest and the next. This model is designed to support the development of applications to support tourists in understanding narrative connections between fixed objects in a physical space.

For the purpose of addressing sub question 2 of this thesis, it was used to create a visitor experience within a sculpture garden in the grounds of a museum. By providing QR codes to scan next to artworks that gave an entry point to conceptual stories about the piece they were standing in front of, it was possible to track visitors' physical movements, through their sequence of QR codes scans and the traversal through conceptual stories via analytics of which links they clicked to access different parts of stories. This work was aligned to work on the Decipher project and Storyscope tool for creating museum narratives, which was occurring at the same time.

The findings of this study suggested that museum visitors are favouring physical proximity as a guide for navigating between objects but that they are still interested in knowing how objects are related, as evidenced through the exploration of story links. Whilst this study did have some limitations (previously discussed), overall feedback from the museum professionals was that the approach to creating device content that showed both physical and conceptual navigation was interesting. This in turn can be seen to validate the model that was used to inform the design.

One conclusion from this study, therefore, is that in addition to the conceptual narratives that were explored through the first study and through the model of curatorial inquiry, there is also a different type of narrative that exists in the physical space, that of the 'in the moment' navigation through the environment. In some cases, this narrative may conflict with the conceptual story. The next studies were designed to explore this in more depth through two controlled studies and to answer the final two sub questions of the thesis, which will be explored in parallel.

Sub questions 3 and 4 (SQ3-4): What effect do different types of prompt have on decisions made about navigating multiple points of interest? What is the relative importance of physical and conceptual proximity 'in the wild' for tourists navigating multiple points of interest?

Two studies were designed to explore these questions from two different yet complementary perspectives. The *first* was a controlled lab study which placed participants in the role of city tourists and the *second* was an analysis of data obtained from Foursquare check ins for three towns in the U.K.

These studies identified that when travelling between a number of cultural artefacts in a physical space, people are influenced by popularity of artefacts or close physical proximity in deciding where to go next. This is despite the evidence that people want to understand how the places and artefacts they are engaging with are related to one another. This is of importance, since the majority of research into developing intelligent tour guides for museums and cities focuses on discovering what the tourist is interested in and prompting them to then visit these places. The Foursquare study additionally confirmed findings from previous work by revealing that popularity has a strong impact on visitor behavior.

Having addressed the sub questions, it is now possible to return to the main question:

> ***How do different types of narrative support the understanding of the relationships between objects either online or in the physical world, when they are either in a fixed configuration or can be moved?***

Overall, this thesis identifies two different types of narrative that play a role in mediating how people construct meaning across a set of diverse objects or resources in a physical space. These are the *physical narratives* that tell of the route taken between one object and the next and the *conceptual narratives* that provides coherence through similarities of story setting and theme. However, in exploring these two narratives in depth, other types of narratives have on occasion revealed themselves. While they have not been the focus of the thesis they can now be discussed.

One such narrative is the personal narrative that a museum or city visitor experiences that is based on their own beliefs, cultural background and knowledge, such as the vernacular narratives described by Rowe et al. (2002). A personal narrative may be attached to a single object, or it can be about a number of objects and they are perceived as being similar or different based on the individual knowledge of the reader. Another such narrative is the ‘post visit narrative’. This first came to light in discussion of trail editing of the museum (Peterson and Levene, 2003). These are the narratives that people tell after a visit, however it is possible that some decisions are made during the visit that are influenced by the thought of these later narrative tellings. One example could be the lure of popularity, the ability to say after the visit ‘I saw the Mona Lisa and this is what I thought of it’ and have a shared experience with other acquaintances that have visited it before, or to ‘show off’ to those acquaintances who have not visited.

A further example is the narrative that co-exists alongside the tourist activities - the day-to-day activities of finding parking, going for a coffee, or planning the visit to allow a stop for lunch at a convenient moment. These can conflict with both the conceptual and physical narratives discussed within this thesis. They can also be likened to the ‘player narratives’ of computer games. The act of wandering around a game world trying to find the next thing to engage with to advance the game, an experience which is distinctly separate to the story that the game is trying to tell. Whilst not within the scope of this thesis, there is possibly some insight that can be gained from studies into these player narratives and the strategies developed to ensure they work with rather than detract the overall game experience.

If multiple narrative experiences are possible, then the next question to ask is how can technology be used to provide appropriate support. Focusing once again on the conceptual and physical narratives identified within the core of this work, the findings from the studies described within this thesis support the idea that instead of telling tourists where to go, the goal should be to develop mobile tour guides which allow museum visitors and city tourists to be spontaneous in choosing where to go. Visitors should be free to choose their own strategies and navigation methods. Technology might support them by developing a locally coherent story around each object or place that links it to related objects or places that are either within or without the same physical neighbourhood. When the objects inhabit the same neighbourhood then the visitor may have already visited it, or may visit it in the future, thus strengthening their understanding of the relationships between objects and places. The goal of the content provided through the tour guide is to support the visitor in making sense of the ways in which artefacts or places are connected to one another through the stories that link them. These stories may tell of shared events in history, of the people that have been associated with them through time, and of common thematic relationships. They might range from the dramatic to the mundane. The aim is to facilitate the visitor in later mental construction of their own stories, which is a form of *trail editing* (Peterson and Levene, 2003). It has been discussed that stories are a natural way in which people think and communicate. Therefore, this thesis proposes that narrative principles are an appropriate way to show the relationships between objects and places, through shared settings (time and place) or theme (common people or other properties). These stories may simply be the visitor's personal mental reflection on their day, or it could form the basis of their own story that could be published as a blog post or as a curated series of photographs.

While it has not been the focus of the thesis to find ways to generate content and identify relationships for the proposed tour guide, a few suggestions are now made. Firstly, it is possible to manually author content for a device, using expert knowledge of the place. This has limitations, because the expert may not know every place that the visitor would want to go. A further possibility is to use online sources to mine information. Possible sources include tools such as Foursquare or Tripadvisor for identifying key venues in a location and Wikipedia, from which the text about each place can be mined for information related to narrative properties. Algorithms could then be applied to build coherent narratives across the content. As previously discussed, this method for story building was used for generating the content for the first tour guide used in the IMMA experiment, using IMMAs own object text as input for the algorithms. The output was then verified by the professionals. This suggests that this could be a viable approach. A final possibility is to use crowdsourcing of information. One application of the crowdsourcing approach could be to find the places that people are visiting, then to use this to search for accepted sources of information about the place, such as a Wikipedia entry, or an official tourist page. A second application could be to elicit information about places from tourists themselves. These unofficial viewpoints could encompass a multitude of different viewpoints on a place and identify different reasons why a place could be interesting depending on their own background and needs. This source of information could in the future be used to find many alternative stories across places for different types of users. One example could be based on interest, finding different narrative threads to show for users who are interested in how places are linked by architecture or those who are interested in how places are linked through a common history of use. Another example could be to find places that are related according to how accessible they are for disabled visitors with different disabilities, or how accessible they are by different forms of transport. What is interesting about these different narrative threads is that it is possible to explore multiple perspectives on places across the city, since the tour guide will no longer guide the visitor on a physical path.

The QraTour scenario introduced in the previous chapter focuses on using the model of physical and conceptual neighbourhoods to create a mobile application that provides information as to how to navigate a place using physical and conceptual proximity. Further extensions to the tour guide that fall outside the scope of this thesis could include other social media-like functions, such as the ability to include different categories of place, such as cafes or restaurants (as found in Foursquare or Tripadvisor), and to also include crowd-sourced recommendations or perspectives on various places. In Carol's scenario (section 8.3.1), this could mean that QraTour shows her popular cafes or restaurants to visit from her current location, and for tourist sites she can choose to filter contributed information either by popularity of poster, by 'expertise' (official vs. tourist-contributed information) or by similar profile of the poster to herself, based on stated preferences or the places she has visited and used the app, or to show places that are suitable to visit given the time of day, either based on it being lunchtime in the case of cafes, or taking into account opening hours, average length of visit, current time and also 'busy-ness' of the place.

9.1 Thesis contribution and final summary

To summarise, the contributions of this thesis are as follows. Firstly, a model of curatorial inquiry was developed to describe how moving objects helps in making sense of the narrative connections between them. This model can be applied to tasks in which it is possible to move objects to reflect the narrative. Secondly, through developing a model that distinguishes the physical space from the conceptual space of objects it has been found that when navigating through physical space, visitors use ideas of physical proximity or popularity to guide their choices, rather than conceptual similarity. This is counter to the way in which many adaptive tour guides operate that try to guide visitors to visit conceptually related items.

This thesis set out to answer questions about the stories that people tell or experience around collections of objects or places. The answers are perhaps not too surprising. People find it easier to answer questions from online content when they can move the content around as they work out how to frame their narrative response. People don't want to walk out of their way, even across a small space, just for a more coherent narrative experience across a set of cultural objects or places. However, with their natural propensity for storytelling people will use the information at their disposal to mentally or physically create stories about their experiences. They are interested in being given information that can help them to do this, such as being told stories that link the places they have visited even when they may visit them in a non-coherent order. The overall conclusion of this thesis is that technology to support reasoning across objects in either the physical or virtual space should take into account this natural ability that people have for telling stories. Rather than dictating a narrative order, it should allow people the freedom to explore amongst objects in whichever way they choose, yet provide appropriate support for them in telling their own stories.

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11 APPENDICES

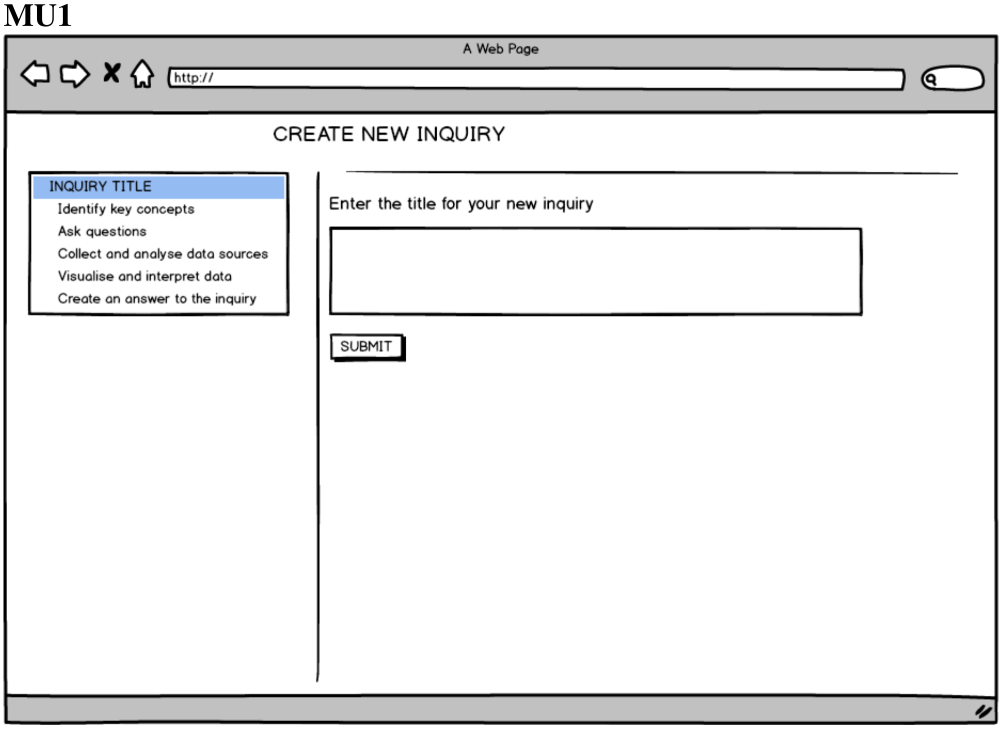
11.1 Appendix A – QrAte storyboard

The following explains the mapping between the stages of a curatorial inquiry and the QrAte tool. Each stage of the curatorial inquiry model is explained with reference to one or more wireframe mockups (MU1-8) which formed part of a design document from which the QrAte tool itself was developed.

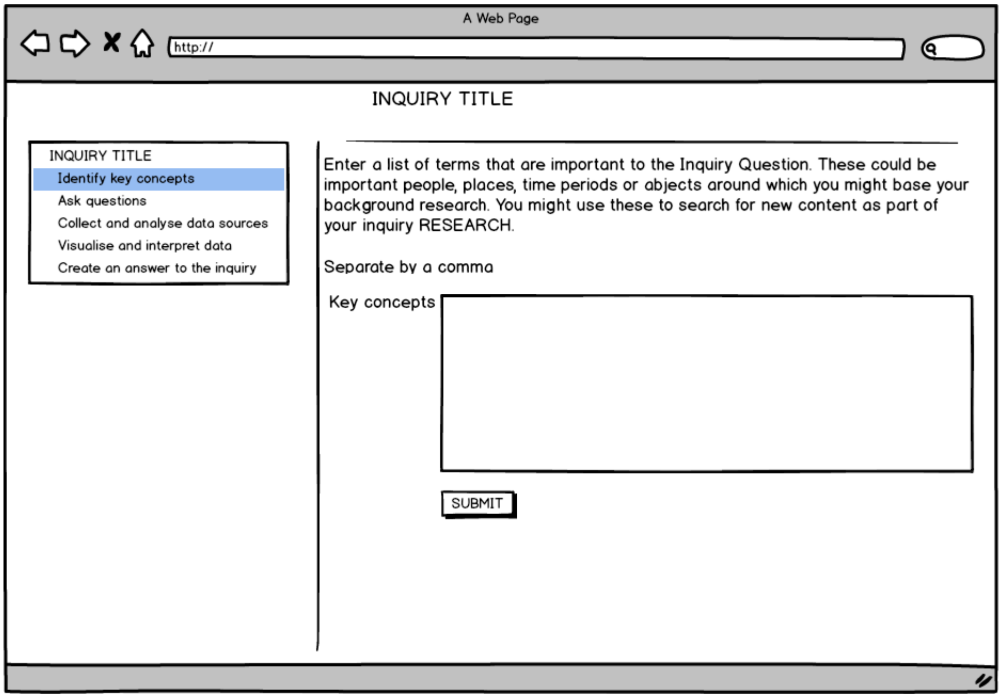
Stage: Research/recuration
Description: choose a learning goal and define the task boundaries.
Activities:

- The user (teacher or student) creates a new inquiry and gives it a title that reflects the learning goal (MU1).
- From within this inquiry, the user selects the menu item 'identify key concepts' where they can identify important people, places, time periods and objects associated with the inquiry that might be used as search terms for future content(MU2)
- The user selects the menu item 'ask questions' where they can add sub-questions to the inquiry that further refines and defines boundaries for the task

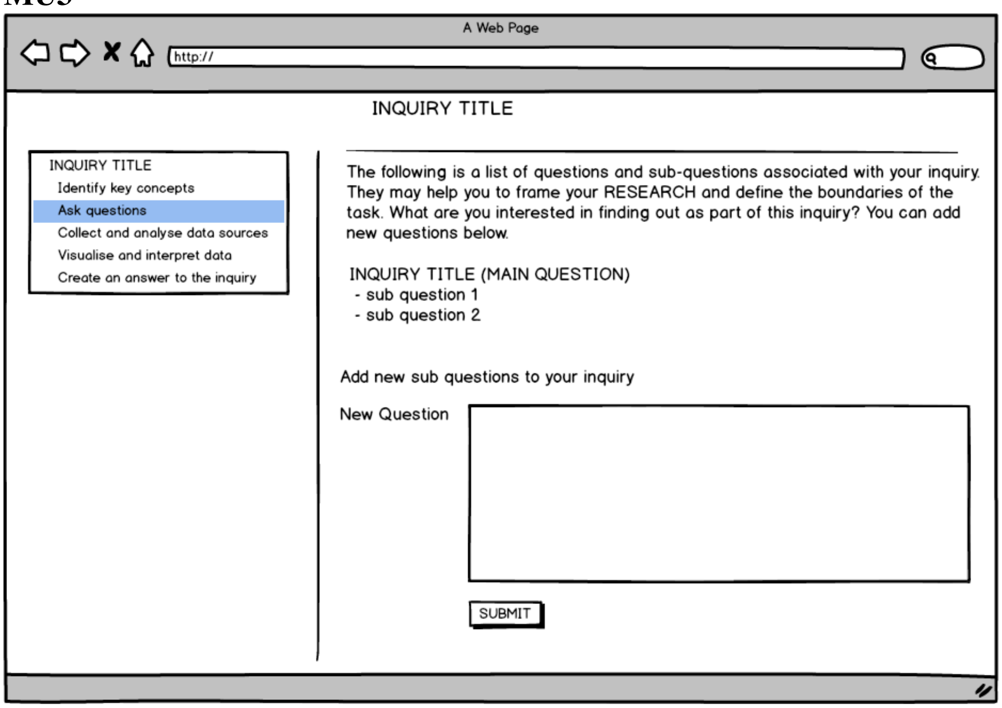
MU1



MU2


A Web Page
http://
INQUIRY TITLE
INQUIRY TITLE
Identify key concepts
Ask questions
Collect and analyse data sources
Visualise and interpret data
Create an answer to the inquiry
Enter a list of terms that are important to the Inquiry Question. These could be important people, places, time periods or objects around which you might base your background research. You might use these to search for new content as part of your inquiry RESEARCH.
Separate by a comma
Key concepts
SUBMIT

MU3


A Web Page
http://
INQUIRY TITLE
INQUIRY TITLE
Identify key concepts
Ask questions
Collect and analyse data sources
Visualise and interpret data
Create an answer to the inquiry
The following is a list of questions and sub-questions associated with your inquiry. They may help you to frame your RESEARCH and define the boundaries of the task. What are you interested in finding out as part of this inquiry? You can add new questions below.
INQUIRY TITLE (MAIN QUESTION)
- sub question 1
- sub question 2
Add new sub questions to your inquiry
New Question
SUBMIT

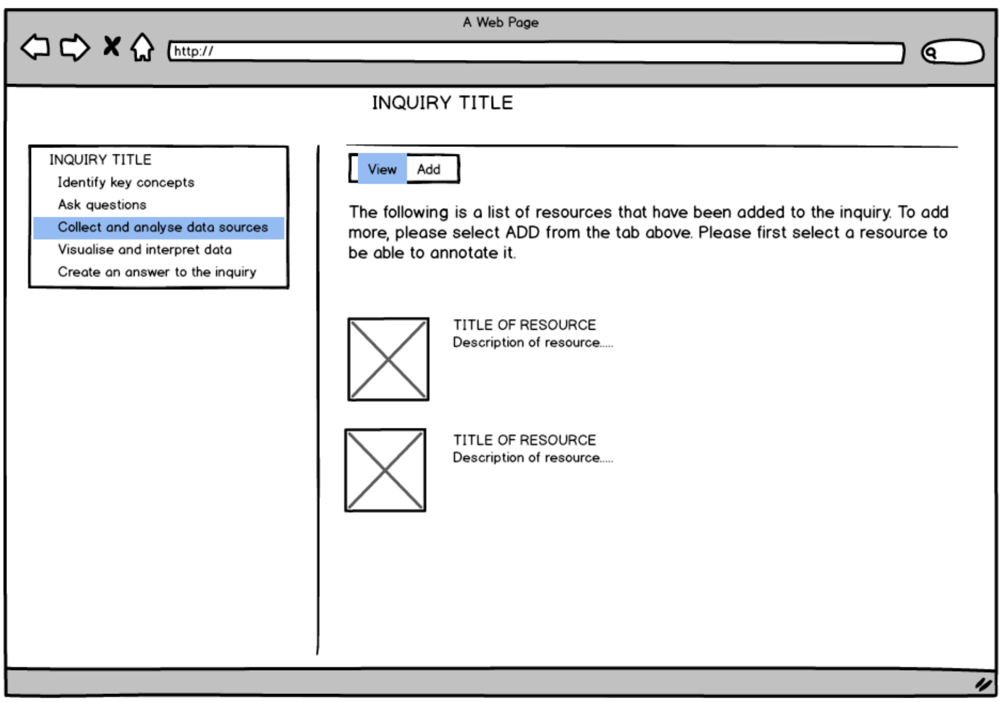
Stage: Content selection and collection

Description: identifying and collecting potential primary and secondary source materials, making judgements on which resources are useful and which are not.

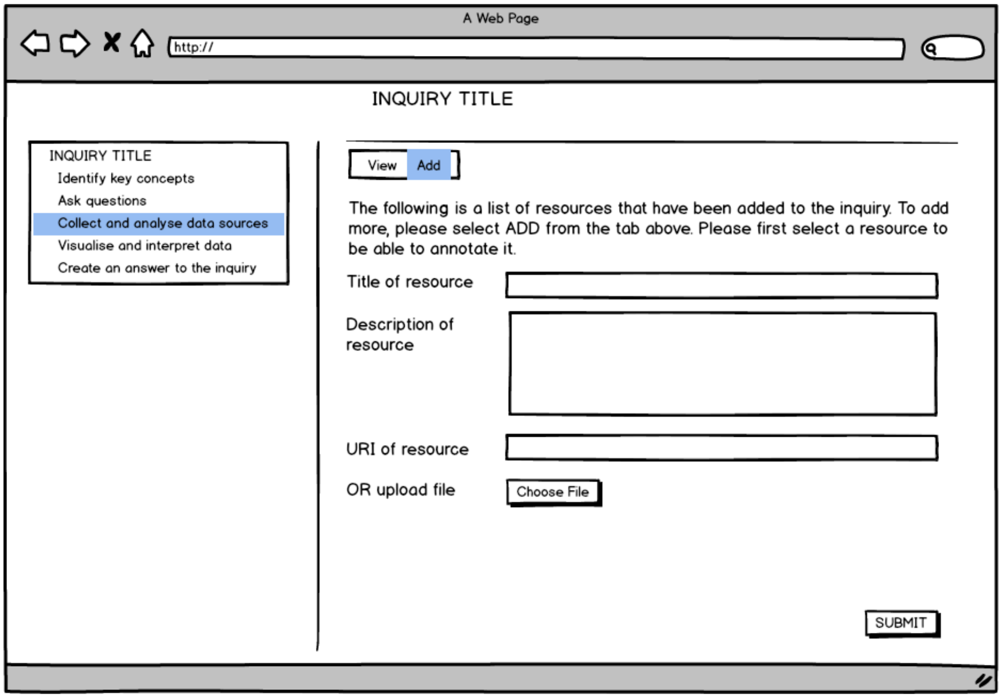
Activities:

- The user views resources that have already been associated with the inquiry (MU4). They can also remove items from this list.
- The user decides to add a new resource (MU5). Content may be added from local files on a computer or can link to a web resource. Key concepts from a previous stage may help by providing terms for a search.

MU4



MU5



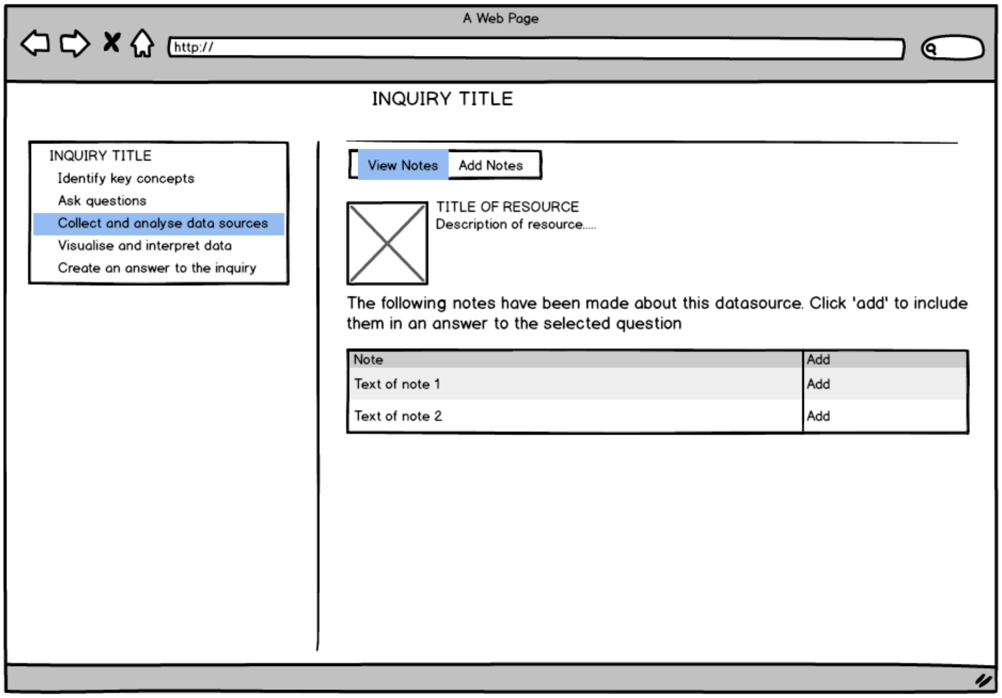
Stage: Interpretation of individual content

Description: annotate individual content to identify important facts and events.

Activities:

- The user selects an existing resource and views annotations that they have already made on this resource and decides whether they should be added as answers to the question. This will automatically include the associated resource with their final answer (MU6). Although it is not shown here, the user has also the option to create a new annotation (note) for a resource, which they can tag with key concepts that are available for the inquiry.

MU6



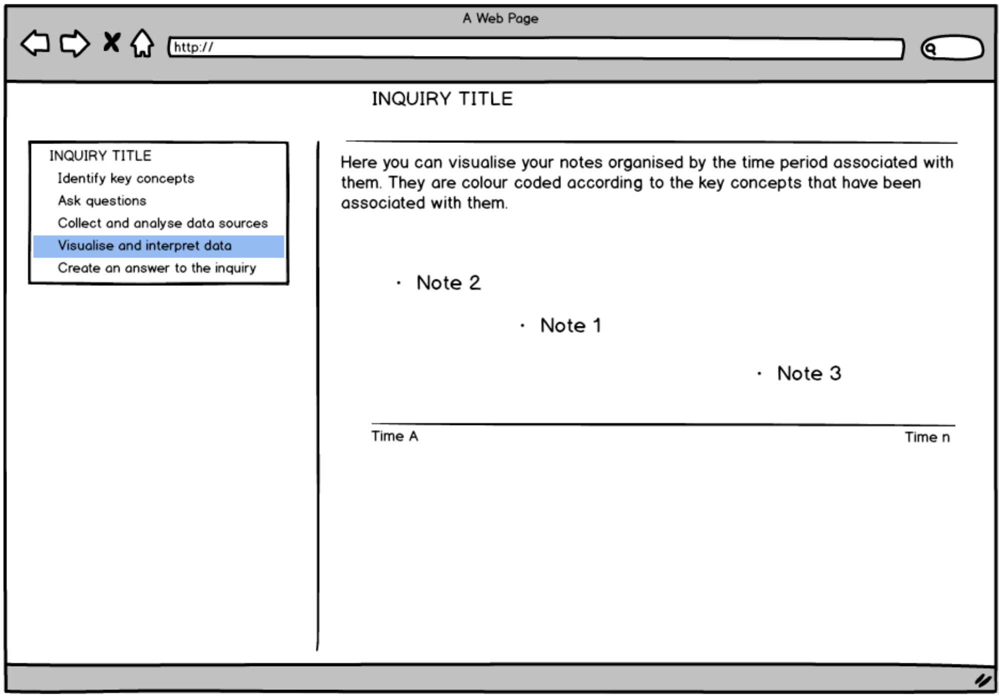
Stage: Interpretation across content

Description: annotate from a task perspective, finding the important relations linking content and annotations.

Activities:

- The user can view notes on a timeline, which are further colour coded according to the key concepts they have been tagged with (MU7).

MU7



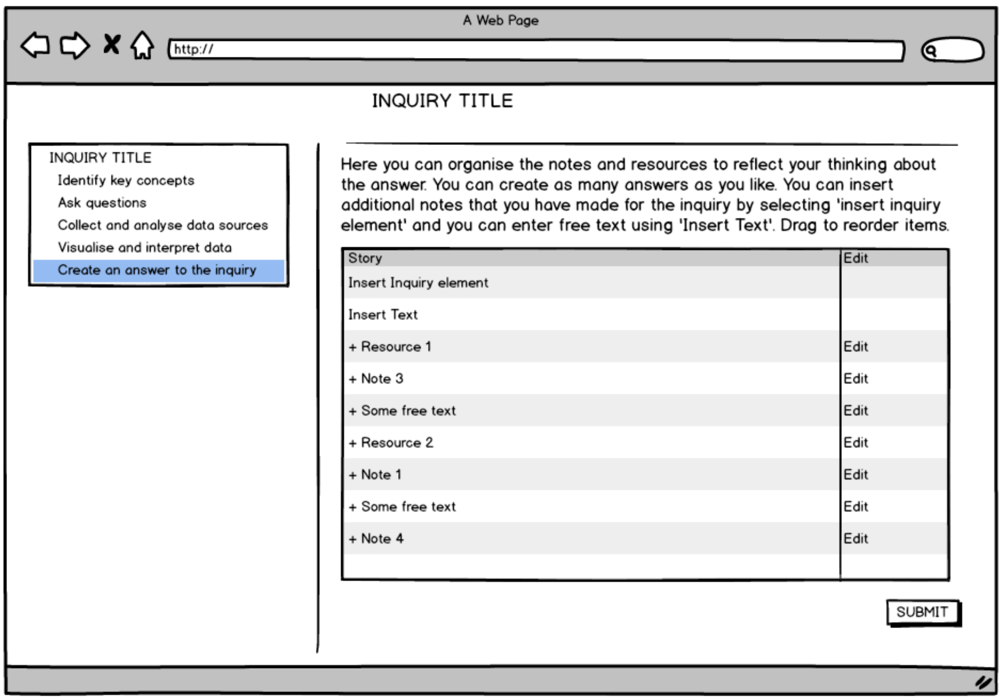
Stage: Organisation of content and annotations

Description: organising (and re-organising) the annotations and content to develop a coherent story that answers the inquiry question. This involves identifying and organising sources (and their related annotations) that evidence important parts of the story and which should form part of the final narrative and using the annotations made when interpreting across content to link them together.

Activities:

- The user can create an answer to the inquiry by moving around the notes that they have made on the content (which is automatically included with the associated note). They can make new text to explain the relationships between items and they can also edit the annotations of content (effectively creating new notes). In this way, this stage also supports the **interpretation of individual content** and the **interpretation across content** of the curatorial inquiry model (MU8).

MU8



Stage: Narration (presentation to an audience)

Description: creating a presentation to an audience through a chosen medium that reflects how the content was organised in the previous stage.

Activities:

- The user creates the final narrative based on the answer to the inquiry that was created in the previous step. This can be an essay, a poster, a play, etc. This stage is therefore not supported directly by the tool.

11.2 Appendix B – Wall materials used in the virtual tour

The Gates of Hell

The Gates of Hell (French: La Porte de l'Enfer) is a sculptural group work by French artist Auguste Rodin that depicts a scene from "The Inferno", the first section of Dante Alighieri's Divine Comedy.

It was comissioned in 1880 to be delivered by 1885. Rodin continued to work on it until his death in 1917.

It stands at 6 metres high, 4 metres wide and 1 metre deep and contains 180 figures. The figures range from 15 centimetres high up to more than one metre. Several of the figures were also cast independently by Rodin.

The Thinker in the Gates (detail from the Gates of Hell)

Detail from the upper left-hand door

Please scan the QR code below

Dancing the Can-can

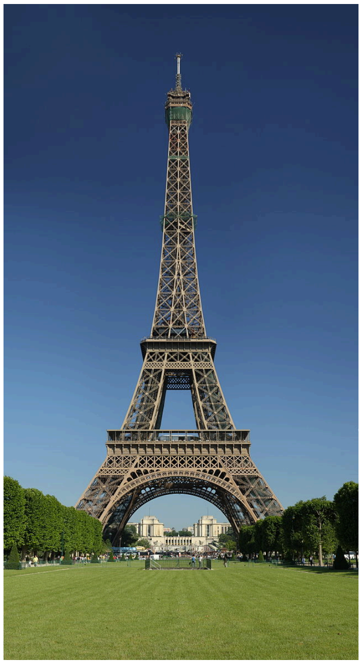
The can-can, which first appeared in Paris, is a high-energy and physically demanding music hall dance, traditionally performed by a chorus line of female dancers who wear costumes with long skirts, petticoats, and black stockings. The main features of the dance are the lifting and manipulation of the skirts, with high kicking and suggestive, provocative body movements. The Infernal Galop from Jacques Offenbach's Orpheus in the Underworld is the tune most associated with the can-can.

This picture, taken by a French photographer at the height of the can can's popularity at the end of the 19th century, depicts four dancers performing the high kick.

The Moulin Rouge nightclub in Paris is known as the spiritual birthplace of the can-can

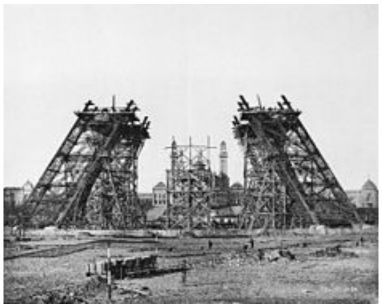
Please scan the QR code below

The Eiffel Tower



The Eiffel Tower is an iron lattice tower located on the Champ de Mars in Paris, France. It was named after the engineer Alexandre Gustave Eiffel, whose company designed and built the tower.

Erected in 1889 as the entrance arch to the 1889 World's Fair, it was initially criticised by some of France's leading artists and intellectuals for its design, but has become both a global cultural icon of France and one of the most recognizable structures in the world.



7 December 1887: Construction of the legs with scaffolding.

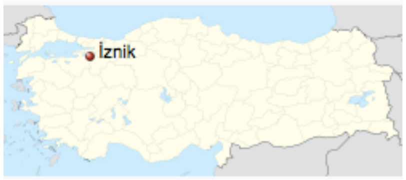
First drawing of the Eiffel Tower by Maurice Koechlin including size comparison with other Parisian landmarks such as Notre Dame de Paris, the Statue of Liberty and the Vendôme Column.

Please scan the QR code below

Dish with a Lion

Iznik pottery originates in Iznik, Turkey, and is a decorated ceramic that was produced from the last quarter of the 15th century until the end of the 17th century. The meticulous designs combined traditional Ottoman arabesque patterns with Chinese elements.

Between 1520-1566 under the reign of Süleyman the Magnificent, demand for İznik wares increased. Jugs, hanging lamps, cups, bowls and dishes were produced, inspired by metalwork and illuminated books as well as Chinese ceramics. Many large dishes were made with looser designs, incorporating ships, animals, trees and flowers.



Location of Iznik, Turkey

Fruit sellers carrying ceramic Iznik jars in front of Sultan Murad III, c 1582

Please scan the QR code below

White Earthenware Vase

Poole Pottery was a pottery manufacturer based in Poole, Dorset, U.K. The company was founded in 1873 on Poole quayside, where it continued to produce pottery by hand before moving its factory operations away from the quay in 1999.

Production continued at the new site in Sopers Lane until its closure in 2006.

The pottery shop remains open on Poole Quay, selling Poole Pottery giftware

Poole Quay

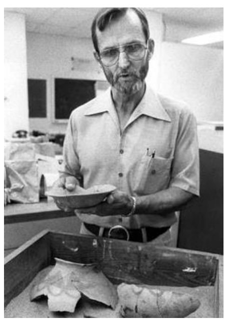
Poole is a town in Dorset (UK).
Highlighted here in red.

Please scan the QR code below

Socorro Red-on-Brown Jar

This jar was recovered from the Old Socorro Mission in New Mexico. It was made by the mission's Piro or mestizo inhabitants sometime between 1684 and 1740 and represents a blending of Native and European styles. Its depiction of a human head on the body of a lion is what art historians refer to as a "Grotesque," and may be an expression of the Catholic faith.

The old Socorro Mission, New Mexico



Dr. Rex Gerald led his class in archeological investigations at the Old Socorro Mission. Here he works on reconstruction of the unusual decorated brownware vessel found at the site.

Please scan the QR code below

Dance (I)

The Dance (La Danse) refers to either of two related paintings made by Henri Matisse between 1909 and 1910. The preliminary version, shown here, is entitled Dance I and is Matisse's study for the second version. It uses paler colors and less detail. The composition or arrangement of dancing figures is reminiscent of Blake's watercolour "Oberon, Titania and Puck with fairies dancing" from 1786.

It is also featured in the background. of Matisse's La Danse with Nasturtiums (1912). It has been the inspiration for work by other artists.

The Dance (After Matisse) by Lucy Unwin

The Daydream by J. Seward Johnson, inspired by Matisse's painting 'The Dance'

Please scan the QR code below

"La Danse" with Nasturtiums

Henry Matisse's representations of his studio often include glimpses of other artwork. In La Danse with Nasturtiums (1912) he depicts the left half of his large canvas, Dance I. The carefully arranged furniture in the foreground flattens the pictorial space. The back leg of the tripod sculpture stand appears to rest in the grass of the painting behind it. Similarly, the chair in the left corner is placed so that the top rung of its back extends a horizontal purple stripe across the canvas.

Henry Matisse (1869 – 1954)

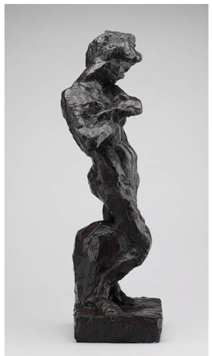
Dance (I)

Please scan the QR code below

Madeleine (I)

Henry Matisse (1869-1954) is best known as a painter. However his activities as a sculptor extended through most of his career and resulted in some eighty pieces.

Beginning with studies of other artists work, soon he began to sculpt compositions of his own devising, focusing exclusively on the human body, most often female, which was the primary subject for his paintings, drawings, and prints as well. The two periods of his greatest sculptural production were 1900–1913 and 1922–32. *Madeleine, I* (1901) and *Madeleine, II* (1903) are typical of his early figurative work.



Madeleine II, Matisse, 1903

Jaguar Devouring a hare, Matisse (1899/1901). Early sculpture based on work by Antoine-Louis Barye (1850)

Please scan the QR code below

The Stravinksy Fountain

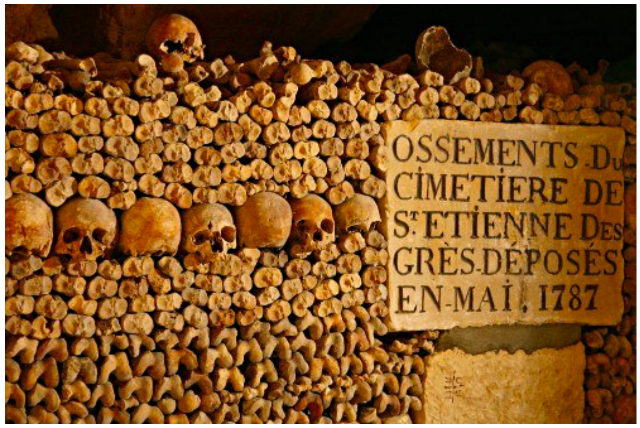
The Stravinsky Fountain is a public fountain ornamented with sixteen works of sculpture, moving and spraying water, representing the works of composer Igor Stravinsky. It was created in 1983 by sculptors Jean Tinguely and Niki de Saint Phalle, and is located on Place Stravinsky, next to the Centre Pompidou, in Paris.

The Elephant

'Love'

Please scan the QR code below

The Catacombs of Paris



The Catacombs of are underground ossuaries in Paris, France. Located south of the former city gate the ossuaries hold the remains of about six million people and fill a renovated section of caverns and tunnels that are the remains of historical stone mines, giving it its reputation as "The World's Largest Grave".

Opened in the late 18th century, the underground cemetery became a tourist attraction on a small scale from the early 19th century, and has been open to the public on a regular basis from 1874.

An organisation of skulls and bones within the catacombs

Crypt of the Sepulchral Lamp

Please scan the QR code below

Jardin des Poetes

The Garden of the Poets (or Square of Poets) is a public park in Paris located on the edge of the garden of Auteuil greenhouses, in the 16th arrondissement. Strewn across the quiet garden are stones with plaques on which verses and the name of a poet are inscribed.

There are also many statues and busts of poets. At the center stands a statue of Victor Hugo, created by Auguste Rodin.

Poem by Maurice Careme in the gardens

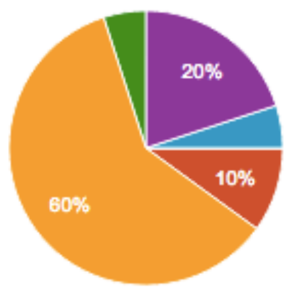
Monument to Victor Hugo, Rodin

Please scan the QR code below

11.3 Appendix C – Full range of questionnaire responses

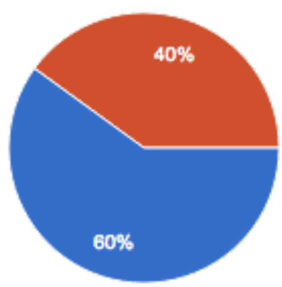
Pre-questionnaire responses

Age



12-17	**0**	0%
18-24	**2**	10%
25-34	**12**	60%
35-44	**1**	5%
45-54	**4**	20%
55-64	**1**	5%
65+	**0**	0%

Gender

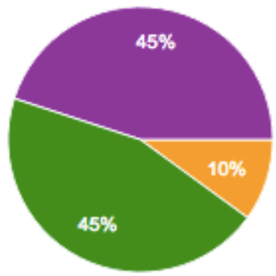


Male	**12**	60%
Female	**8**	40%

First Language

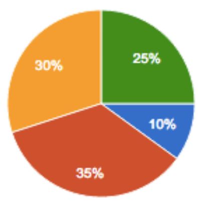
Greece
czech
Urdu
Czech
Arabic
Spanish
Italian
portuguese
English
Greek

Would you consider your level of English to be:



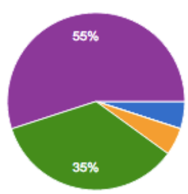
very poor	0	0%
poor	0	0%
fair	2	10%
good	9	45%
excellent	9	45%

On average how many times do you travel each year for the purpose of a holiday (including trips within the UK)



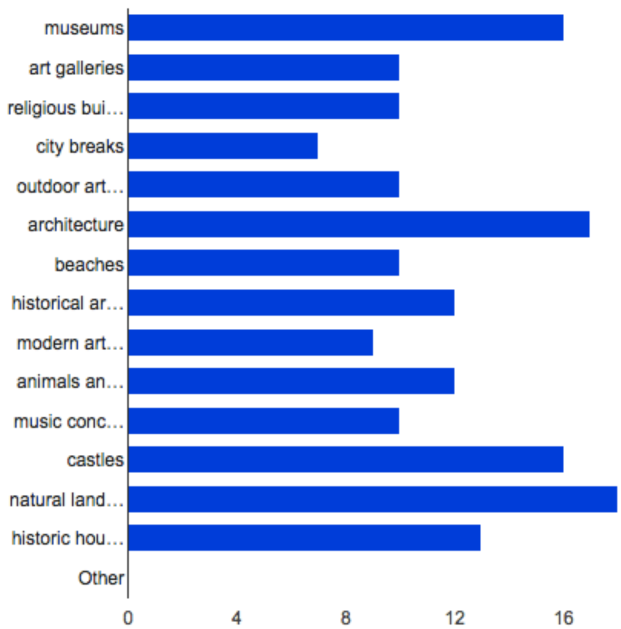
0	2	10%
1-2	7	35%
3-4	6	30%
4+	5	25%

When on holiday, how likely are you to take part in tourist activities (e.g. museums, architecture, parks and gardens)



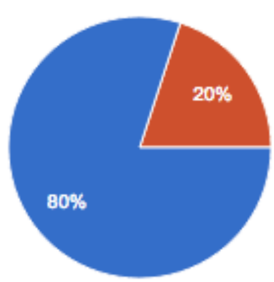
not at all likely	1	5%
not very likely	0	0%
neither likely nor unlikely	1	5%
quite likely	7	35%
very likely	11	55%

What sort of tourist activities do you like? (Tick all that apply)



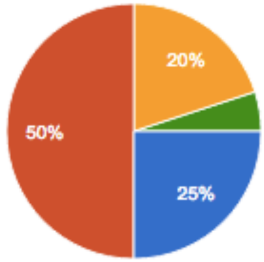
museums	**16**	80%
art galleries	**10**	50%
religious buildings	**10**	50%
city breaks	**7**	35%
outdoor artworks	**10**	50%
architecture	**17**	85%
beaches	**10**	50%
historical artefacts	**12**	60%
modern art and culture	**9**	45%
animals and wildlife	**12**	60%
music concerts/opera	**10**	50%
castles	**16**	80%
natural landscapes	**18**	90%
historic houses	**13**	65%
Other	**0**	0%

Have you ever visited Paris?



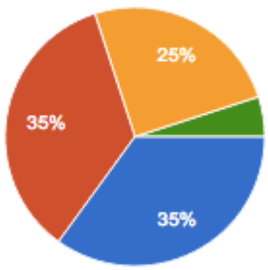
Yes	**16**	80%
No	**4**	20%

How often do you use audio guides?



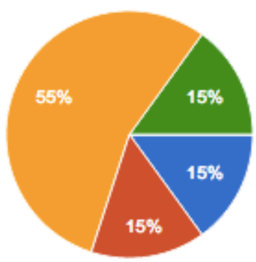
never	**5**	25%
almost never	**10**	50%
sometimes	**4**	20%
fairly often	**1**	5%
very often	**0**	0%

How often do you download tourist apps?



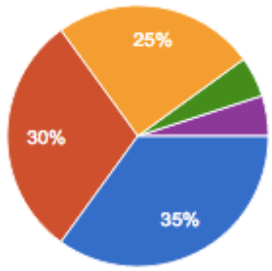
never	**7**	35%
almost never	**7**	35%
sometimes	**5**	25%
fairly often	**1**	5%
very often	**0**	0%

How often do you follow guidebooks?



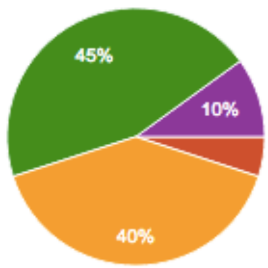
never	**3**	15%
almost never	**3**	15%
sometimes	**11**	55%
fairly often	**3**	15%
very often	**0**	0%

How often do you use a human tour guide?



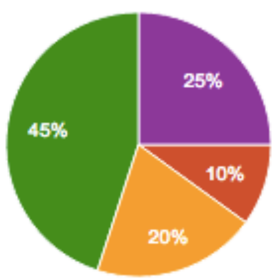
never	7	35%
almost never	6	30%
sometimes	5	25%
fairly often	1	5%
very often	1	5%

How often do you plan your own tour?



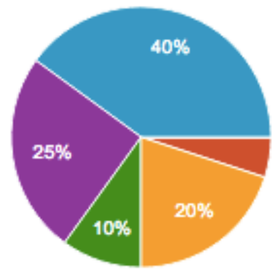
never	0	0%
almost never	1	5%
sometimes	8	40%
fairly often	9	45%
very often	2	10%

How often do you choose your route spontaneously?



never	0	0%
almost never	2	10%
sometimes	4	20%
fairly often	9	45%
very often	5	25%

Which is your preference? (Please choose just one)



audio guide	0	0%
tourist app	1	5%
guidebook	4	20%
human guide	2	10%
own tour	5	25%
spontaneous	8	40%
Other	0	0%

Post-questionnaire responses

Summarise your trip for someone who hasn't been there

The trip contained a nice collection of information about some popular attractions in Paris. oddly enough within the different information points you would also get information about random artifacts from around the world (e.g. pottery from Turkey and the UK). The iPad was useless and added nothing to my trip. Information from the ipad was minimal or non existent and in some occations wrong (e.g. linking mullen rouge and dantes gate..

I had a tour around about a dozen items of cultural interest focussing mostly on crafts, and many of them related to Paris.

I had a trip -mainly in Paris, viewed historical monuments, objects, dances and pieces of older and modern art. My visit to every site was linked to something similar to it, as suggested by the QR, and that guided me through my tour.

It is a mixture of various types of sights, especially information about selected sights in Paris, and with some focus on the work of H.Matisse that is available in one of the museums in Paris and some pottery work across different continents, America, Europe, Asia.

I have looked at different pieces of artwork, most of them in Paris. They included some architectural works such as the Eiffel tower or the Catacumbs, some paintings scultures. There were some art works from Turkey and UK as well.

I visited several locations around Paris, taking in sights to suit all tastes. The parks were filled with sculpture, particularly by the well known French sculptor Auguste Rodin. Also interesting was his carved door surround inspired by Dante's Inferno which incorporates small versions of several of his stand-alone scultures. In the galleries, Henri Matisse's works were prominently displayed, and it was interesting the learn how many different artworks were inspired by him. Many more modern sculptures can be seen around the Pompidou Centre - they are colourful and fascinating to try to understand. If you prefer ancient artefacts, there was pottery of Turkish and South American origin, and it's interesting to compare the naive

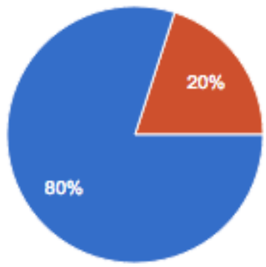
art styles that they displayed. I've always wanted to visit the Catacombs, and at last I can say that I have! I also visited the Eiffel Tower, which is certainly an impressive monument even if not particularly eye-pleasing. If you prefer, it is also still possible to watch the girls dance the Can-Can.
I walk around the 12 interesting places. First I visited the Gates of Hell and then I did the walk following shape of 8. I visited bone cemetery, park of poets and the Stravinsky fountain, then I saw the statue and went to see Eiffel tower. After short visit of Eiffel tower I observed pottery art from Turkey, UK and Mexico. Then I saw few paintings and ended with can-can.
I have seen different places but mainly related to art and history. Some crafts and drawings for known people (including one for a band). Was nice!
A trip around Paris, mostly looking at cultural artefacts, apart from one item from Poole.
The exhibition brings you around historical and other significant parts of Paris, and explores cultural and achitectural features of the city. Some parts of the exhibition are linked with each other, forming a nice path to follow. Particularly ironic was the link from the gates of hell to the Eiffel tower...
It was very interesting to learn a little more about other countries art and it`s cultural influences. I love to learn new things about the world. Of all itens that I saw the ones that made me want to go and experience them in person are located in France. I never have I wish to go there but now I would really love to plan a trip to this country.
A variety of items, some of which were related, spread across hundreds of years.
A brief tour of some of the famous landmarks, poetry and artworks from Europe.
A trip to see the cultural side of Paris and Paris of the 19th century, including Eiffel Tower and a visit to an art musem with many artistic objects including paintings, sculptures and pottery from many countries
This trip takes around 12 sites of Paris. There are mainly modern art items, there is short brief information about them and a QR code to scan.
Interesting trip to some of the sites in paris.
I visited a room which had 12 pictures of sculptures, ornaments and buildings. The vast majority of the pictures related to Paris - either the creator was from Paris or they are displayed in Paris.
An exhibition of key sites around Paris, including archetechture, modern art and History. You are given a picture with information about the place, item or person with a descriptive text underneath.
The items in the exhibition were mainly based around French artists and their work, and related artworks in Paris, with a couple of exceptions such as the Poole Pottery and the Turkish ceramics.
room with 12 stops. each stop gives a small information about chosen topic. One is able get an additional information about connections between stops using QR code reader.

Write down common themes amongst the places and objects you visited

art, architecture, modern art, 19th and 20th century

there seemed to be at least three common themes going on. Landmarks in Paris, artefacts in france and artefacts from around the world.
Sculpture, dance, pottery
Modern art (e.g. Matisse) Paris located (most of them)
90% of the items shown were based in or around Paris. Most of the items were pieces of art All roughly around the same era
Art related I think there one frame in 2 different places (south east and East)
Pottery, Paintings, Places of interest (ET, cemetery,...)
all the itens are strongly envolved with the culture of its country, difining a period of art and the difference between the locations.
Art, Matisse
Paris Ceramics/Pottery Matisse Art Sculpture
Sculptures, artists, Paris, museum
I liked the idea of having a description and example section in each picture. It makes easier for me to know more about the locations.
* Appear to be originated from Europe * Matisse * Potentially a strong view of religion - most likely Catholisim.
Paris, sculpture, crafts, painting, architecture
art (architecture, painting, ...) of 19th or early 20th century
monuments like Eiffel towel and the catacombs potteries from Paris and outside Paris (e.g. Turkey)
Traditional dances older paintings (la danse) and modern art (fountain)
women, flowers, pottery, Paris, French artists,
dance, passage, death.
Architecture, paintings, sculpture
Human and animal figures, at rest and in motion. Pottery across the world. Naive and figurative art styles and so on. The works of Matisse and Rodin. There was a link between the metalwork of the Eiffel Tower and the surround of the Turkish plate, but I wouldn't have realised it if I hadn't been asked this question!

Did you see any UK pottery?



Yes	**16**	80%
No	**4**	20%

Who created the Gates of Hell?

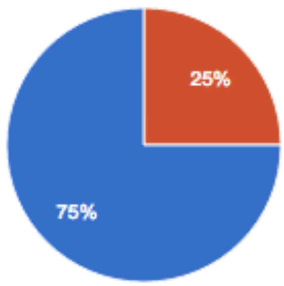
Unknown
I cannot remember who, but I remember that it took him 5 years to create it
Robin
?
Biset
Dante
unfortunately already forgot
cant remember
Don`t remember
Rodin
N/A
I don't remember
Don't know

Which artist created "La Danse" with Nasturtiums ?

?
Mattisse
No idea
unfortunately already forgot
Matisse? (can't remember names...)
Matisse
cant remember
Henri Matisse

N/A
I cant remember
nerris
I don't remember

Did you see any items about 18th century France?



Yes	15	75%
No	5	25%

What did you see before you saw "La Danse" with Nasturtiums?

A painting which was a second version of la danse and looked like half of it - if I remember weel
mexican pottery
Bones vault
Tour Eiffel
No idea
Gates of hell
Danse No. 1
cant remember
A decorated plate
Round bowl with Lion head
The grave inside of old mine in Paris
The Can Can
Rodin sculptures in the park
the other Danse
Dance I.
Mexican pottery
I don't remember
I dont remember.

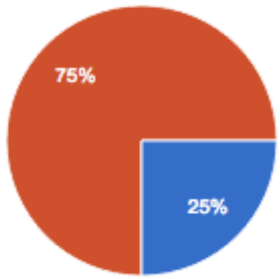
In what year was '"La Danse" with Nasturtiums' painted?

can't remember
Again, no idea
1903
?
1880
No idea
1912
don't know.. 1910s-1920s ish. I remember the Danse was painted in 1909?
second half of 19th century
1905 I think
N/A
1831
I don't remember
1902 (?)
I forget

Where is the Stravinsky Fountain situated?

Pompidou Centre, Paris
Unsure
park of poets
At the corner(south east)
Centre Pompidou
Stravinsky Park
Adjacent to the Pompidou Centre
Again, no idea
somewhere in Paris
Place Stravinsky, Paris, near the Centre Pompideau.
paris
France
do not remember
Next to Pombidou centre
Park in Paris, I can't remember the name
Near the Pompidou
Near the louvre

Did you see a Polish dish?



Yes	**5**	25%
No	**15**	75%

What did you see after you saw The Stravinsky Fountain?

the vase from poole,uk (?)

This was the last Item

Photo of can-can, I think, but the fountain was the last one I hadn't seen before (end of tour, kind of)

Dont remember

Pottery from UK

statue of woman

No idea

I believe it was the last

A statue

This was the last item I saw

That was the end

Paris underground

can-can (again)

The plate

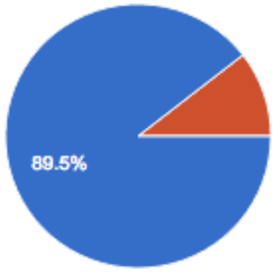
N/A

Madeleine

I forget

the underground cemetery

Is there a statue at the centre of the Jardin des Poètes?

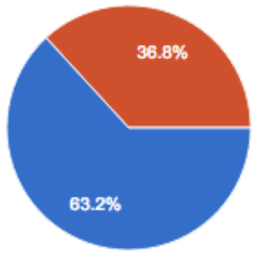


Yes	**17**	89.5%
No	**2**	10.5%

What was the original purpose of the Eiffel Tower?

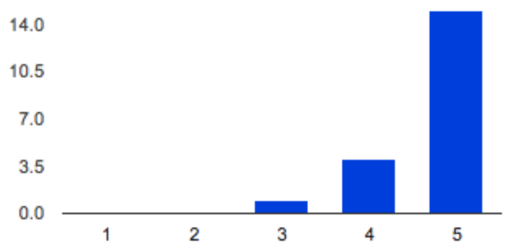
Main gate to the World Faire
Opening to an exhibition
Mast for radio signals
No idea
Structure
The gateway to an exhibition
Entrance archway
Entrance archway to the 1887 show
Paris Exposition centre piece
World expo 1889
Entrance to a international exposition
N/A
The entrance to the World Fair
monument
exhibition piece for a fair
to be the gate entrance of a fair
The opening gate for the 1889 fair
In the entrance of exhibition fair

Was the Stravinsky Fountain created in 1983?



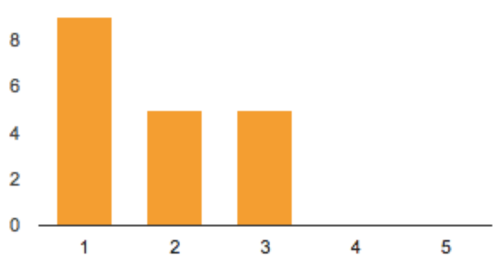
Yes	**12**	63.2%
No	**7**	36.8%

How easy did you find it to scan the QR codes?



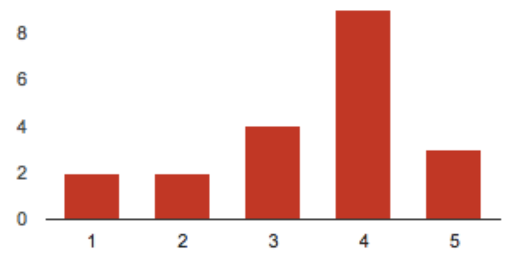
not at all: 1	**0**	0%
2	**0**	0%
3	**1**	5%
4	**4**	20%
extremely: 5	**15**	75%

How useful did you find the information on the mobile device?



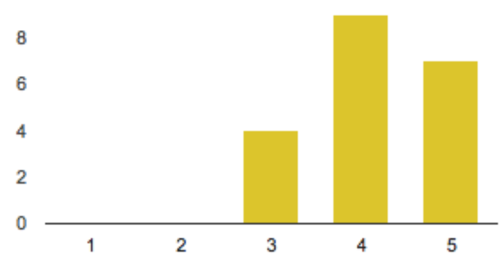
not at all: 1	**9**	47.4%
2	**5**	26.3%
3	**5**	26.3%
4	**0**	0%
extremely: 5	**0**	0%

How likely would you be to scan QR codes to get additional information in the future?



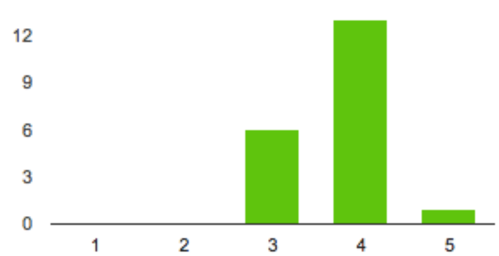
not at all: 1	**2**	10%
2	**2**	10%
3	**4**	20%
4	**9**	45%
extremely: 5	**3**	15%

How easy was it to navigate between points of interest?



not at all: 1	**0**	0%
2	**0**	0%
3	**4**	20%
4	**9**	45%
extremely: 5	**7**	35%

How enjoyable did you find the overall 'visit'?



not at all: 1	**0**	0%
2	**0**	0%
3	**6**	30%
4	**13**	65%
extremely: 5	**1**	5%

What other ways would you like to be given information about tourist sites?

Paper leaflet or map.

I like checking online reviews prior to any of the trips

I always prefer to get my informations in person and if needed writen on paper. But I can also be interested in tourist formation by e-mail.

maybe more information on the ipad. or something interactive (again on the ipad). as it is now it is just information on posters..

I would like that after visiting a site it gives me suggestions about what place visit nexy so I can "follow" a meaningful route. I would like a more interactive information, in which I can click and discover more things after scanning the QR code.

Touch screen that provides a sort of interaction activity (learnign game perhaps) about the exhibiton item, Audio guide (but needs to be tell a story rather than just listing facts of items exhibited) Mobile app (just like the ipad provided now)

usually I prefer guide books, because they are easy to flip through when I need to find something, however most preferable for me would be a mobile application with interactive map, perhaps integrating information from multiple sources

One way to give information to tourist is to introduce the physical things related to the site. Showing a sculpture or a card specifically related to site might make it easier to remember information relevant to the site.

Tourist guide before the visit.

An off-line app would be very nice, one you can carry around with maps, and that can be consulted without draining batteries, or in areas with poor connection (e.g., countryside, where you can only get GPS signal)

I respond better and retain more information when given in an entertaining way (via human tour guide - someone you can ask questions of) OR, if I am able to find more information when scanning QR codes, which simply showed a picture. An interactive map could help. E.g. When the first Matisse artwork QR code is scanned, it provides you with some background information, after which you are given information about the second art peice and are directed towards it. Rather than simply listing related sites, more information about the nature of the link would have helped to determine if it is likely to be interesting.

I always think information leaflets are a waste of paper but take them anyway partly because in a day of technology my smart phone doesnt always work with the venue's wifi connection or is too slow to bring up the details before i've moved on to the next item. I think a venue either leads it self to be able to read solmething there and then or to have a website address availble before you go into it.

The info I was getting on the ipad was very limited. I think that I would have paid more attention to the details if they were in the ipad rather than the text. It was not convenient to stand and read the text. In addition, I would have loved it if the ipad would give me a 3D view of the item.

I like relationship among different things that I see, which then makes it easier to make the whole picture about the tour.
Leaflet so you could access further information when home.
Visitor ratings
books, posters, information boards, digital media triggered in a more discrete way that doesn't mean I have to stand out when I am finding the information (e.g. beacons or other locational mechanisms on my phone)
I would like the QR to situate the tourist site between other variables (map, stories about it, etc) and make it easier for me to remember. Also, keep this information saved while visiting a site of similar interest. When used in a building, it would be nice alongside the similar tourist sites to also provide directions to that site (e.g. "take me there" button).

What other comments can you give about the overall experience?

Nice seelction of items to be used in this study, pleasant overall
I wasn't sure if there was a clear narrative to the sequence of items that I viewed, I liked it when pieces referenced each other. The QR code reader worked a lot better than I expected. I'd be self conscious of stepping up to something in a busy public area to hold up a device to grab a QR code. I liked the subsidiary information provided on the posters (not just about the work itself but related information). I liked it when items seemed to link to each other. I was expecting more content on the iPad. I thought maybe I'd be able to zoom on the iPad to see more detail of the original art piece (though I understand when confronted by the real piece you'd not be so interested in this).
It was ok
interesting choice of items, I like being suggested what to visit, getting a schedule for my trip I thought the QR codes could provide more information I like that I got a map, even though at first I thought I would not need it, it was nice to see at which point of the tour am I
The QR codes would scan more easily if they were slightly angled away from the wall rather than being flat against the wall. The webpage accessed by the QR code could expand on the information shown on the wall and it would be nice if you could click on the related items shown and be taken to information about these items or even shown on a map on the iPad how to get from one item to the related item.
there didnt seem to be a common theme linking all the interest points together. they were all loosely linked with France but there was no clear link from one item to the next (if you followed them in the order presented). I tried to see if i did something wrong by not following the suggested routes but the ipad app seemed to link items in a weird way (i.e. can-can dance and the gate to

hell) or give ambicuous instructions like "points of interest around you". The ipad quicly became a burden to my experience; something i had to carry around with me just because someone gave it to me.
It was interesting to be able to build up a picture of the sort of attractions that were available, and to see how together they form a cultural narrative. It was also interesting to read about links to distant attractions, although obviously in the circumstances it's not possible to make use of that. However, it's not necessarily always desirable to choose another site that is similar to the one I most recently visited. It's easy to get sidetracked and lose the trail. Also, it can be nice to mix things up a bit, then come back to a subject. It would have been nice to be able to keep a note of attractions I intended to visit - although obviously in the context of the experiment it was easy to keep these things in my head, in real life it would not.
Overall it is a good experience.
Was expecting additional information related to each exhibit through the bar code but unless I missed something, the web pages that appeared from scanning the code provided no further information at all.
When I saw the same picture after scanning the QR code, I thought that there is no additional information, so I think I checked the information there only twcice - I would put bigger font or different picture to make it more attractive.
Nice I liked it :))
It`s always nice to learn new things so it was definetly worth it.
I got small problem with locating the bone cemetery at the beginning of the visit.. :)
I enjoyed learning a little from the 'stations' but, would have liked a lot more information when the QR code was scanned. It was frustrating not to be able to click for more information as it could have been a VERY interesting tour and due to it not being available through my preferred methods of infomation absorption, I regret that I may not remember very much of it.
Connecting tourist sites with other similar is really useful as you are trying to find what the link between the sites is. For example, I was trying to figure out what the link between a turkish and a french pottery was. I think in the end the only link was that they were both potteries. Maybe there should be a line of text explaining why and how these are similar.
I thought it was a high brow representation of Paris
As I have used a tablet to scan the codes, I was expecting some kind of interactive information coming from the device. Maybe some resources that could be displayed beyond a traditional information panel (video, 3d objects...).
It took me some time to realize that places shown on tablet can also be found in the room. I revisited some places again to get more details and connections between interrelated places.

I did not realise at first that the mobile content gave a pointer to a related point of interest, I noticed it the second time around. I think it's a nice way of creating a story line, a way to guide people through visits. I was a bit surprised that links were not two-way, that is the gate of hell linked to the Eiffel tower, but the Eiffel tower did not link to the gate of hell. In hindsight, it makes sense, but maybe bidirectional information (making it explicit) would serve visitors better.
I didnt find the QR codes useful because i was expecting them to tell me more about the subject matter, or to be able to enlarge the pictrues in order to see more details.

11.4 Appendix D – Sample JSON and Data from Foursquare API calls.

The following is an example of returned JSON from the Foursquare API call for Anne Hathaway's cottage.


```
"response":{
   "nextVenues":{
      "count":5,
      "items":[
         {
            "id":"4b94d7fdf964a520f88434e3",
            "name":"Shakespeare's Birthplace",
            "contact":{
               "phone":"01789296083",
               "formattedPhone":"01789 296083",
               "twitter":"shakespearebt"
            },
            "location":{
               "address":"Henley Street",
               "lat":52.19389969335785,
               "lng":-1.708025336265564,
               "postalCode":"CV37 6QW",
               "cc":"GB",
               "city":"Stratford-upon-Avon",
               "state":"Warwickshire",
               "country":"United Kingdom",
               "formattedAddress":[
                  "Henley Street",
```

```
                  "Stratford-upon-Avon",
                  "Warwickshire",
                  "CV37 6QW"
               ]
            },
            "categories":[
               {
                  "id":"4bf58dd8d48988d190941735",
                  "name":"History Museum",
                  "pluralName":"History Museums",
                  "shortName":"History Museum",
                  "icon":{
                     "prefix":"https:\/\/ss3.4sqi.net\/img\/categori
es_v2\/arts_entertainment\/museum_history_",
                     "suffix":".png"
                  },
                  "primary":true
               }
            ],
            "verified":true,
            "stats":{
               "checkinsCount":3796,
               "usersCount":3477,
               "tipCount":24
            },
            "storeId":""
         },
```

```
{
   "id":"4b90d397f964a520b59833e3",
   "name":"Mary Arden's Farm",
   "contact":{
      "phone":"01789338535",
      "formattedPhone":"01789 338535"
   },
   "location":{
      "address":"11 Station Rd",
      "lat":52.221455199863456,
      "lng":-1.7608657180800082,
      "postalCode":"CV37 9UN",
      "cc":"GB",
      "neighborhood":"Wilmcote",
      "city":"Stratford-upon-Avon",
      "state":"Warwickshire",
      "country":"United Kingdom",
      "formattedAddress":[
         "11 Station Rd",
         "Stratford-upon-Avon",
         "Warwickshire",
         "CV37 9UN"
      ]
   },
   "categories":[
      {
         "id":"4deefb944765f83613cdba6e",
```

```
                    "name":"Historic Site",
                    "pluralName":"Historic Sites",
                    "shortName":"Historic Site",
                    "icon":{
                       "prefix":"https:\/\/ss3.4sqi.net\/img\/categori
es_v2\/arts_entertainment\/historicsite_",
                       "suffix":".png"
                    },
                    "primary":true
                 }
              ],
              "verified":false,
              "stats":{
                 "checkinsCount":200,
                 "usersCount":156,
                 "tipCount":5
              },
              "url":"http:\/\/www.shakespeare.org.uk\/visit-the-
houses\/mary-ardens-farm.html"
           },
           {
              "id":"4c598a9267ac0f47ca6a044c",
              "name":"Royal Shakespeare Theatre",
              "contact":{
                 "phone":"08448001110",
                 "formattedPhone":"0844 800 1110",
```

```
        "twitter":"thersc"
    }. . . . . .
```

The following is a complete list of the returned Foursquare results. The first item in each list is the place for which the API call was made. The list below this is, in rank order, up to 5 most popular next venue check-ins according to the response from a Foursquare API call. National Railway Museum
- York Minster
- Bettys Cafe Tearooms
- York Tap - omitted (bar)
- Museum Gardens
- York - omitted (the town)

York Minster
- Bettys Cafe Tearooms
- The Shambles
- Clifford's Tower
- Museum Gardens
- National Railway Museum

Bettys Cafe Tearooms
- York Minster
- Clifford's Tower
- York Designer Outlet - omitted (out of town)
- National Railway Museum
- Museum Gardens

Museum Gardens
- York Minster
- National Railway Museum
- Yorkshire Museum
- Bettys Cafe Tearooms
- Clifford's Tower

The Shambles
- York Minster
- Clifford's Tower
- Bettys Cafe Tearooms
- Jorvik Viking Centre
- The Golden Fleece - omitted (bar)

Clifford's Tower
- York Castle Museum
- York Minster
- Bettys Cafe Tearooms
- Jorvik Viking Centre
- The Shambles

Yorkshire Museum
- York Minster
- Museum Gardens
- York Castle Museum
- Bettys cafe Tearooms
- National Railway Museum

York Castle Museum
- Clifford's Tower
- York Minster
- Jorvik Viking Centre
- Bettys Cafe Tearooms
- National Railway Museum

Jorvik Viking Museum
- York Minster
- Cliffords Tower
- Bettys cafe Tearooms
- National Railway Museum
- York Castle Museum

* ** * ** * * ** * * ** * * * ** * *
BATH
* ** * ** * * ** * * ** * * * ** * *

Roman Baths
- Stonehenge - omitted (out of town)
- Sally Lunns historic House and Museum
- Pump Room
- The Royal Crescent
- Bath - omitted (the town)

Sally Lunns
- The Roman Baths
- The Royal Crescent
- Stonehenge - omitted (out of town)

- Jane Austen Centre
- Bath - omitted (the town)

The Pump Room
- The Roman Baths
- Thermae Bath Spa
- Sally Lunns
- Jane Austen Centre
- The Royal Crescent

The Royal Crescent
- The Roman Baths
- The Circus
- Royal Victoria Park
- Sally Lunns
- Bath - omitted (the town)

Jane Austen Centre
- Regency Tea Room
- The Circus
- The Roman Baths
- The Royal Crescent
- Sally Lunns

Thermae Bath Spa
- The Roman Baths
- Sally Lunns
- Pump Room
- The Raven - omitted (bar)
- The Cork - omitted (bar)

The Circus
- The Royal Crescent
- The Roman Baths
- No. 1 Royal Crescent
- Assembly Rooms
- Fashion museum

Royal Victoria Park
- The Royal Crescent
- Botanical Gardens
- Queen Square

- Roman Baths
- Bath - omitted (the town)

Regency Tea Rooms
** no next venues

No. 1 Royal Crescent
- Roman Baths
- Royal Victoria Park
- Jane Austen Centre
- Sally Lunns
- The Circus

Assembly Rooms
- The Royal Crescent
- Roman Baths
- The Circus
- Fashion Museum
* count was only 4.

Fashion Museum
- Roman Baths
- Royal Crescent
- Jane Austen Centre
- The Circus
- Sally Lunns

Botanical Gardens
- Royal Victoria Park

Queen Square
- The Circus
- The Royal Crescent
- Bath - omitted (the town)
- Roman Baths
- Jane Austen Centre

* ** * ** * * * ** * * * ** * * * ** * *
STRATFORD UPON AVON
* ** * ** * * * ** * * * ** * * * ** * *

Anne Hathaways cottage
- Shakespeares birthplace
- Mary Ardens Farm
- Stratford upon Avon
- Royal Shakespeare Theatre
- The Shakespeare Centre

Shakespeares birthplace
- Nash's House And New Place
- Royal Shakespeare Theatre
- Stratford upon Avon
- the shakespeare centre
- Anne hathaways cottage

Mary Ardens Farm
- shakespeares birthplace
- Anne hathaways cottage
** only 2 next venues

Royal Shakespeare Theatre
- shakespeares birthplace
- dirty duck - omitted (bar)
- swan theatre
- the encore - omitted (bar)
- Stratford upon Avon - omitted (the town)

the shakespeare centre
- shakespeares birthplace
- nashs house and new place
- Stratford-upon-Avon
- Box Brownie - omitted (coffee shop)
- Royal Shakespeare theatre

Nashs house and new place
- Hall's Croft
- royal shakespeare theatre
- shakespeares birthplace
- anne hathaways cottage
- shakespeares grave

swan theatre
- royal shakespeare theatre
* only one

Halls croft
- Nashs house and new place
- shakespeares grave
- anne hathaways cottage
- shakespeares birthplace
- royal Shakespeare theatre

shakespeares grave
- shakespeares birthplace
- halls croft
- royal shakespeare theatre
- anne hathaways cottage
- Stratford upon avon - omitted (the town)

11.5 Appendix E – Sample Code for Calculating Cosine Similarity

```
* ** * ** * * ** * * ** * * *  ** * *
PHP CODE
* ** * ** * * ** * * ** * * *  ** * *

<?php

function getData($url){
  $apikey = 'adcaee66f8ea0eaf130e803dd6ff8b837be5bd75';
 $endpoint =
'http://access.alchemyapi.com/calls/url/URLGetRankedNamedEntities?apikey=' . $apikey
. '&outputMode=json&url='.$url;
  $session = curl_init($endpoint);
  curl_setopt($session, CURLOPT_RETURNTRANSFER, true);
 $data = curl_exec($session);
  return $data;
  echo $data;
  curl_close($session);
 }

   $pages = array(
"http://en.wikipedia.org/wiki/York_Minster",
"http://en.wikipedia.org/wiki/Bettys_and_Taylors_of_Harrogate",
"http://en.wikipedia.org/wiki/York_Museum_Gardens",
"http://en.wikipedia.org/wiki/The_Shambles",
"http://en.wikipedia.org/wiki/York_Castle",
"http://en.wikipedia.org/wiki/Yorkshire_Museum",
"http://en.wikipedia.org/wiki/York_Castle_Museum",
"http://en.wikipedia.org/wiki/Jorvik_Viking_Centre"
);

foreach ($pages as $page)

{

            $url = urlencode($page);
            $output     = getData($url);
            $search_results = json_decode($output);

            if ($search_results === NULL) die('Error parsing json');
            $entities = $search_results->entities;
```

```
        foreach ($entities as $entity)
                {
                        echo $entity->text;
                        echo ' ';
                }

}
?>
```

* ** * ** * * ** * * ** * * * ** * *
PYTHON CODE
* ** * ** * * ** * * ** * * * ** * *

```
import re, math
from collections import Counter

WORD = re.compile(r'\w+')

def get_cosine(vec1, vec2):
    intersection = set(vec1.keys()) & set(vec2.keys())
    numerator = sum([vec1[x] * vec2[x] for x in intersection])

    sum1 = sum([vec1[x]**2 for x in vec1.keys()])
    sum2 = sum([vec2[x]**2 for x in vec2.keys()])
    denominator = math.sqrt(sum1) * math.sqrt(sum2)

    if not denominator:
      return 0.0
    else:
      return float(numerator) / denominator

def text_to_vector(text):
    words = WORD.findall(text)
    return Counter(words)


text1 = 'Anne Hathaway William Shakespeare Shakespeare Birthplace Trust Shottery Newlands Farm Warwickshire the house England Bartholomew 36 hectares 90 acres 1 mile 1.6 km '

text2 = 'William Shakespeare The house Shakespeare Birthplace Trust Shakespeare Birthplace Trust Shakespeare Centre Joan Hart Thomas Hart William Stratford Thomas
```

Court Wilmcote Maidenhead Inn England Forest of Arden Maidenhead Inn Warwickshire Charles Dickens Dr Levi Fox Thomas Hornby Harts Maidenhead Lewis Hiccox P. T. Barnum walled garden Committee Elizabeth Mrs Hornby. Thomas Carlyle official England Isaac Watts Susanna John Keats windows. Act of Parliament Lord Tennyson Lord Byron William Thackeray. US. Director of the Trust Sir Walter Scott Alfred '

```
vector1 = text_to_vector(text1)
vector2 = text_to_vector(text2)
cosine = get_cosine(vector1, vector2)
print cosine
```

11.6 Appendix F – WEKA outputs from decision tree analysis

Bath

=== Run information ===

Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2
Relation: whatever-weka.filters.unsupervised.attribute.Remove-R1-4,6-7,9
Instances: 156
Attributes: 4
chk_to
top
p_nearest
c_nearest
Test mode:10-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree

: no (156.0/13.0)

Number of Leaves : 1

Size of the tree : 1

Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances	142	91.0256 %
Incorrectly Classified Instances	14	8.9744 %
Kappa statistic	-0.012	
Mean absolute error	0.1564	
Root mean squared error	0.2852	
Relative absolute error	99.1504 %	
Root relative squared error	103.0502 %	
Total Number of Instances	156	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
	0	0.007	0	0	0	0.488	yes
	0.993	1	0.916	0.993	0.953	0.488	no
Weighted Avg.	0.91	0.917	0.84	0.91	0.874	0.488	

=== Confusion Matrix ===

```
  a   b   <-- classified as
  0  13 |   a = yes
  1 142 |   b = no
```

Stratford upon Avon

=== Run information ===

Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2
Relation: whatever-weka.filters.unsupervised.attribute.Remove-R1-4,6-7,9
Instances: 72
Attributes: 4
chk_to
top
p_nearest
c_nearest
Test mode:10-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree
----

chk_to <= 3204: No (64.0/4.0)
chk_to > 3204: Yes (8.0/3.0)

Number of Leaves : 2

Size of the tree : 3

Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

```
Correctly Classified Instances          62               86.1111 %
Incorrectly Classified Instances        10               13.8889 %
Kappa statistic                          0.2157
Mean absolute error                      0.1935
Root mean squared error                  0.3324
Relative absolute error                 85.0622 %
Root relative squared error            100.2871 %
Total Number of Instances               72
```

=== Detailed Accuracy By Class ===

```
               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.222     0.048      0.4       0.222     0.286      0.559    Yes
                 0.952     0.778      0.896     0.952     0.923      0.559    No
Weighted Avg.    0.861     0.687      0.834     0.861     0.843      0.559
```

=== Confusion Matrix ===

```
  a  b   <-- classified as
  2  7 |  a = Yes
  3 60 |  b = No
```

York

=== Run information ===

```
Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     whatever-weka.filters.unsupervised.attribute.Remove-R1-4,6-7,9
Instances:    72
Attributes:   4
              chk_to
              top
              p_nearest
              c_nearest
Test mode:10-fold cross-validation
```

=== Classifier model (full training set) ===

J48 pruned tree

----

chk_to <= 3606: No (64.0/3.0)
chk_to > 3606: Yes (8.0/2.0)

Number of Leaves : 2

Size of the tree : 3

Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances	67	93.0556 %
Incorrectly Classified Instances	5	6.9444 %
Kappa statistic	0.6667	
Mean absolute error	0.1254	
Root mean squared error	0.258	
Relative absolute error	55.0904 %	
Root relative squared error	77.8372 %	
Total Number of Instances	72	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
	0.667	0.032	0.75	0.667	0.706	0.695	Yes
	0.968	0.333	0.953	0.968	0.961	0.695	No
Weighted Avg.	0.931	0.296	0.928	0.931	0.929	0.695	

=== Confusion Matrix ===

```
 a  b   <-- classified as
 6  3 |  a = Yes
 2 61 |  b = No
```

Bath

=== Run information ===

Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2

```
Relation:     whatever-weka.filters.unsupervised.attribute.Remove-R1-4,6-8
Instances:    156
Attributes:   4
              chk_to
              top_3
              p_nearest
              c_nearest
Test mode:10-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree
------------------

chk_to <= 1977: no (132.0/19.0)
chk_to > 1977: yes (24.0/6.0)

Number of Leaves  :   2

Size of the tree :        3


Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         131               83.9744 %
Incorrectly Classified Instances        25               16.0256 %
Kappa statistic                          0.4961
Mean absolute error                      0.2688
Root mean squared error                  0.3694
Relative absolute error                 73.8657 %
Root relative squared error             86.8025 %
Total Number of Instances              156

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.486     0.05       0.75      0.486     0.59       0.623    yes
                 0.95      0.514      0.856     0.95      0.9        0.623    no
Weighted Avg.    0.84      0.404      0.831     0.84      0.827      0.623
```

=== Confusion Matrix ===

```
  a   b   <-- classified as
 18  19 |   a = yes
  6 113 |   b = no
```

Stratford upon Avon

=== Run information ===

```
Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     whatever-weka.filters.unsupervised.attribute.Remove-R1-4,6-8
Instances:    72
Attributes:   4
              chk_to
              top_3
              p_nearest
              c_nearest
Test mode:10-fold cross-validation
```

=== Classifier model (full training set) ===

```
J48 pruned tree
------------------

c_nearest = No
|   chk_to <= 671: No (45.0/4.0)
|   chk_to > 671: Yes (13.0/4.0)
c_nearest = Yes
|   p_nearest = No
|   |   chk_to <= 567: No (6.0/2.0)
|   |   chk_to > 567: Yes (2.0)
|   p_nearest = Yes: Yes (6.0)

Number of Leaves  :     5

Size of the tree :      9


Time taken to build model: 0 seconds
```

=== Stratified cross-validation ===
=== Summary ===

```
Correctly Classified Instances          58               80.5556 %
Incorrectly Classified Instances        14               19.4444 %
Kappa statistic                          0.5528
Mean absolute error                      0.2513
Root mean squared error                  0.3808
Relative absolute error                 57.4843 %
Root relative squared error             81.5562 %
Total Number of Instances               72

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.696     0.143      0.696     0.696     0.696      0.779    Yes
                 0.857     0.304      0.857     0.857     0.857      0.779    No
Weighted Avg.    0.806     0.253      0.806     0.806     0.806      0.779

=== Confusion Matrix ===

  a  b   <-- classified as
 16  7 |  a = Yes
  7 42 |  b = No
```

York

```
=== Run information ===

Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     whatever-weka.filters.unsupervised.attribute.Remove-R1-4,6-8
Instances:    72
Attributes:   4
              chk_to
              top_3
              p_nearest
              c_nearest
Test mode:10-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree
------------------
```

```
chk_to <= 3606
|   c_nearest = No: No (53.0/11.0)
|   c_nearest = Yes
|   |   p_nearest = No
|   |   |   chk_to <= 1483: No (2.0)
|   |   |   chk_to > 1483: Yes (6.0/1.0)
|   |   p_nearest = Yes: Yes (3.0)
chk_to > 3606: Yes (8.0)

Number of Leaves  :     5

Size of the tree :      9


Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances          57               79.1667 %
Incorrectly Classified Instances        15               20.8333 %
Kappa statistic                          0.5238
Mean absolute error                      0.3052
Root mean squared error                  0.4098
Relative absolute error                 64.8792 %
Root relative squared error             84.5013 %
Total Number of Instances               72

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.556     0.067      0.833     0.556     0.667      0.697    Yes
                 0.933     0.444      0.778     0.933     0.848      0.697    No
Weighted Avg.    0.792     0.303      0.799     0.792     0.78       0.697

=== Confusion Matrix ===

  a  b   <-- classified as
 15 12 |  a = Yes
  3 42 |  b = No
```

Table showing the number of checkins recorded from Foursquare for each venue and the number of users that made these checkins. The repeat visitors is calculated from these numbers and gives an indication of whether the venue is likely to attract repeat visitors, or not.

	checkins	users	repeat visitors
York Minster (YM)	6030	4310	0.714759536
National Railway Museum (NRM)	3606	2827	0.783971159
Bettys Cafe Tearooms (BCT)	3215	2527	0.78600311
Museum Gardens (MG)	2538	1331	0.524428684
Clifford's Tower (CT)	2117	1642	0.775625886
The Shambles (TS)	1483	1125	0.758597438
Jorvik Viking Centre (JVC)	1412	1077	0.762747875
York Castle Museum (YCM)	1135	969	0.853744493
Yorkshire Museum (YSM)	530	459	0.866037736
Roman Baths (RB)	8096	7553	0.932929842
Sally Lunns (SL)	1977	1782	0.901365706
Pump Room (PR)	805	741	0.920496894
The Royal Crescent (TRC)	2370	1871	0.789451477
Jane Austen Centre (JAC)	824	779	0.94538835
Thermae Bath Spa (TBS)	1897	1697	0.894570374
The Circus	1395	1097	0.786379928

(TC)			
Royal Victoria Park (RVP)	1650	894	0.541818182
Regency Tea Room (RTR)	89	88	0.988764045
No. 1 Royal Crescent (ORC)	357	338	0.946778711
Assembly Rooms (AR)	426	360	0.845070423
Fashion museum (FM)	414	406	0.980676329
Botanical Gardens (BG)	278	117	0.420863309
Queen Square (QS)	1737	588	0.33851468
Anne Hathaways cottage (AHC)	671	582	0.867362146
Shakespeares birthplace (SB)	3409	3104	0.910530947
Mary Ardens Farm (MAF)	179	135	0.754189944
Royal Shakespeare Theatre (RST)	3204	1805	0.563358302
The Shakespeare Centre (TSC)	567	383	0.675485009
Nash's House And New Place (NHNP)	396	369	0.931818182
swan theatre (ST)	525	227	0.432380952
shakespeares grave (SG)	268	237	0.884328358
Halls croft (HC)	330	304	0.921212121